संख्या- 154/2020/4082/71-1-2020-जी-307/2017टी0सी0

प्रेषक,

शुभ्रा सक्सेना,
विशेष सचिव
उ0प्र0 शासन।

सेवा में,

महानिदेशक,
चिकित्सा शिक्षा एवं प्रशिक्षण,
उ0प्र0, लखनऊ।

चिकित्सा शिक्षा अनुभाग-1

लखनऊ : दिनॉक 03 नवम्बर, 2020

विषयः- राजकीय मेडिकल कालेजों एवं चिकित्सा संस्थानों में लगाये जाने वाले मेडिकल गैस पाइप लाइन सिस्टम हेतु मानकीकृत तकनीकी विशिष्टियों के निर्धारण के संबंध में।

महोदय,

उपर्युक्त विषयक अपने पत्र संख्या-एमई/बजट/2020-21/503, दिनॉक 03.11.2020 का कृपया संदर्भ ग्रहण करने का कष्ट करें।

2- इस संबंध मे मुझे यह कहने का निदेश हुआ है कि राजकीय मेडिकल कालेजों/चिकित्सा संस्थानों/विश्वविद्यालयों से सम्बद्ध चिकित्सालयों में लगाये जाने वाले मेडिकल गैस पाइप लाइन सिस्टम की स्थापना किये जाने हेतु मेडिकल गैस पाइप लाइन सिस्टम की आवश्यकता एवं औचित्य तथा स्पेसिफिकेशन के निर्धारण तथा बी0ओ0क्यू0 व एस0ओ0पी0 का मानकीकरण किये जाने हेतु निदेशक, इंस्टीट्यूट ऑफ इंजीनियरिंग टेक्नोलॉजी, लखनऊ की अध्यक्षता में गठित समिति द्वारा मेडिकल गैस पाइप लाइन सिस्टम हेतु निर्धारित किये गये स्पेसिफिकेशन, बी0ओ0क्यू0 व एस0ओ0पी0 संलग्न प्रपत्र के अनुसार निर्गत किये जा रहे है। संलग्न स्पेसिफिकेशन व प्रपत्र के आधार पर राजकीय मेडिकल कालेजों/संस्थानों/विश्वविद्यालयों से सम्बद्ध चिकित्सालयों में मेडिकल गैस पाइन लाइन सिस्टम की स्थापना किये जाने की कार्यवाही में निम्न निर्देशों का अनुपालन सुनिश्चित किया जायः-

(1) राजकीय मेडिकल कालेजों/संस्थानों में लगाये जाने वाले मेडिकल गैस पाइप लाइन सिस्टम के स्फेसिफिकेशन संलग्न है, तद्नुसार संलग्न तकनीकी विशिष्टियो के आधार पर मेडिकल गैस पाइप लाइन सिस्टम की स्थापना का कार्य कराया जाये।

(2) राजकीय मेडिकल कालेजों एवं संस्थानों में मेडिकल गैस पाइप लाइन सिस्टम की स्थापना हेतु समिति द्वारा निर्धारित तकनीकी विशिष्टियॉ 03 साल तक वैध रहेंगी। उक्त विशिष्टियों के आधार पर वर्ष 2020-21, 2021-22 एवं 2022-23 में मेडिकल गैस पाइप लाइन सिस्टम की स्थापना का कार्य सुनिश्चित किया जाय।

(3) मेडिकल गैस पाइप लाइन सिस्टम की स्थापना करने से पूर्व यह सुनिश्चित कर लिया जाय कि संबंधित चिकित्सालय में मेडिकल गैस पाइप लाइन सिस्टम की वास्तविक रूप से आवश्यकता है।

(4) मेडिकल गैस पाइप लाइन सिस्टम की स्थापना हास्पिटल की चिकित्सकीय आवश्यकताओं एवं एम0सी0आई0 मानकों के दृष्टिगत किया जायेगा तथा मेडिकल गैस पाइप लाइन सिस्टम के मानक व गुणवत्ता की जिम्मेदारी महानिदेशक, चिकित्सा शिक्षा एवं प्रशिक्षण, उ0प्र0/संबंधित प्रधानाचार्य/संबंधित निदेशक/ कुलपति की होगी।

(5) यह भी सुनिश्चित कर लिया जाए कि मेडिकल गैस पाइप लाइन सिस्टम की स्थापना हेतु पर्याप्त स्थान, भवन आदि उपलब्ध है तथा संचालन हेतु मानव संसाधन उपलब्ध है।

(6) राजकीय मेडिकल कालेज/संस्थान/विश्वविद्यालय में मेडिकल गैस पाइप लाइन सिस्टम की स्थापना किये जाने में व्यापक प्रचार-प्रसार किया जाय।



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(7) मेडिकल गैस पाइप लाइन सिस्टम की स्थापना के सम्बन्ध में समस्त औपचारिकतायें नियमानुसार पूर्ण किये जाने के पश्चात ही मेडिकल गैस पाइप लाइन सिस्टम की स्थापना की जाय। मेडिकल गैस पाइप लाइन सिस्टम की स्थापना सक्षम स्तर का अनुमोदन प्राप्त करनें के पश्चात ही की जाय।

(8) राजकीय मेडिकल कालेजों एवं संस्थानों में मेडिकल गैस पाइप लाइन सिस्टम की स्थापना में 05 वर्ष की वारण्टी/ सी0एम0सी0/ए0एम0सी0 को ई-प्रोक्योरमेन्ट में अनिवार्य रूप से सुनिश्चित किया जाय।

(9) राजकीय मेडिकल कालेजो एवं संस्थानों मैं मेडिकल गैस पाइप लाइन सिस्टम की स्थापना का कार्य ई-टेण्डर के माध्यम से किया जाए तथा इसका व्यापक प्रचार-प्रसार भी किया जाये।

(10) मेडिकल गैस पाइप लाइन सिस्टम की स्थापना प्रक्रिया में सूक्ष्म लघु एवं मध्यम उद्यम तथा निर्यात प्रोत्साहन विभाग के सुसंगत शासनादेशों तथा उ0प्र0 प्रोक्योरमेन्ट मैनुअल 2016 का अनुपालन सुनिश्चित किया जाय।

(11) संलग्न उपकरणों हेतु निर्गत की जा रही विशिष्टियों के तकनीकी पहलुओं की उपयुक्तता का दायित्व कार्यालय ज्ञाप दिनॉक 10.07.2020 द्वारा गठित विशेषज्ञ समिति का होगा।

(12) राजकीय मेडिकल कालेजों/संस्थानों से सम्बद्ध चिकित्सालयों में लगाये जाने वाले मेडिकल गैस पाइप लाइन सिस्टम की प्रस्तावित मानकीकृत तकनीकी विशिष्टियों को निर्धारित किये जाने के संबंध में समस्त औपचारिकताओं का पालन सुसंगत वित्तीय नियमों के अन्तर्गत महानिदेशक/संबंधित संस्थाओं के सक्षम अधिकारियों द्वारा सुनिश्चित किया जायेगा।

(13) संलग्न सैम्पल बी0ओ0क्यू0 व सैम्पल एस0ओ0पी0 मार्गदर्शिका के रूप में रहेंगे।

**संलग्नक-यथोक्त।**

भवदीया,

(शुभ्रा सक्सेना)
विशेष सचिव

संख्या:- 154/2020/4082(1)/71-1-2020 तद्यदिनांक

प्रतिलिपि निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित:-

1. निदेशक, एस0जी0पी0जी0आई0, लखनऊ।
2. कुल सचिव, के0जी0एम0यू0, लखनऊ।
3. कुल सचिव, उ0प्र0 ग्रामीण आयुर्विज्ञान संस्थान, सैफई इटावा।
4. निदेशक, डा0 राम मनोहर लोहिया आयुर्विज्ञान संस्थान, लखनऊ।
5. निदेशक, गवर्नमेन्ट इंस्टीट्यूट आफ मेडिकल साईंसेज, ग्रेटर नोएडा।
6. निदेशक, सुपर स्पेशियलिटी बाल चिकित्सालय एवं स्नातकोत्तर शिक्षण संस्थान, नोएडा।
7. निदेशक, सुपर स्पेशियलिटी कैंसर संस्थान, लखनऊ।
8. समस्त प्रधानाचार्य, स्वशासी एवं राजकीय मेडिकल कालेज, उ0प्र0।
9. निदेशक, हृदय रोग संस्थान, कानपुर तथा जे0 के0 कैंसर संस्थान, कानपुर।
10. चिकित्सा शिक्षा अनुभाग-2, 3 एवं 4
11. गार्ड फाइल।

1-12-2020

आज्ञा से,

( एस0 पी0 सिंह )
अनु सचिव



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शासनादेश संख्या- 154/2020 (4082 /71-1-2020-जी-307/2017टी0सी0,
दिनॉक 03 नवम्बर, 2020 का संलग्नक-1

# STANDARD TECHNICAL SPECIFICATION FOR MEDICAL GAS PIPE LINE SYSTEMS (MGPS)

## MGPS INSTALLATION

### GENERAL

1 Gases used for Human Healthcare, also known as Medical Gases, are strictly controlled by both legislation and standards so as to not impair human physiology. Provision of Oxygen, Nitrous Oxide, Compressed Air and Carbon Dioxide is a life-saving therapeutic Requirement and are listed in Indian Pharmacopoeia 6 (IP 6) or in National Formulary or in US Pharmacopoeia or European Pharmacopoeia. Therefore these are considered drugs and have statutory specifications. These are included in National Pharmacopeia like any other drug and need to be complied with. There is a Pharmacopoeial monograph for each of them, which provides a reliable basis for making an independent and objective judgement as to the quality of these substances. The Pharmacopoeial monograph also provides specifications and test methods for determining compliance with this standard. Indian Drugs and Cosmetics Act provides requirements for procurement, storage, transport and distribution of these gases.

2 Medical Gas Pipeline System (MGPS) is intended to be a safe, convenient and cost-effective alternative to the use of "portable" cylinders, portable compressors and portable suction units, providing gas or vacuum for clinical needs without the associated problems of porterage, noise and space wastage. It delivers medical gases, medical air and other gases from the source of supply to the appropriate terminal unit by means of a pipeline distribution system.

3 The Quality of Gas delivered by MGPS has to be as per various Pharmacopoeial requirements.

4 **It is proposed to provide the Piped Medical Gases, Medical Compressed Air & Medical Vacuum Installation (henceforth referred to as MGPS Installation) to the functional areas in the newly built Basement +Ground+..... building with .....+ bed capacity in ..... Hospital.....(address).**

5 This will be a new, independent MGPS Installation complete with its captive Manifold & Plant Room and a Cylinder Store Room.

6 This MGPS Installation will provide the following piped Medical Gases and allied services.

- 6.1 Medical Oxygen
- 6.2 Medical Nitrous Oxide
- 6.3 Medical Compressed Air 4
  Medical Air 4: This is compressed air at gauge pressure of 4.1 bar (414 kPa or 60 psi) at the terminal units and shall provide the drive for ventilators in Operating Rooms, on the recovery beds, on the ICU Beds, etc.
- 6.4 Medical Vacuum
- 6.5 Gas Flow Monitoring and Gas Alarm System
- 6.6 Provision of Accessories

7 This MGPS Installation is provided for medical use only, and shall not be used to supply any of its service to any Laboratory, Workshop or purely Mechanical Services.

8 The main design objective is to ensure that the installation shall be of adequate capacity, safe and reliable.

9 This MGPS Installation will have Internet Protocol (IP) communicationsacross network based control systems with a remote monitoring system for System status and Alarms. It will provide interface for integration with Integrated Building Management System (iBMS System) when such a system becomes available after remodelling of .....Hospital.**(OPTIONAL)**

10 The Integrated Building Management System shall never be used for operating any of MGPS installation components.**(OPTIONAL)**

11 The provision, installation, operation and maintenance of this MGPS Installation shall be governed by the following standards and guidelines.

| Indian Standard | International Standard | |
|---|---|---|
| IS/ISO 7396 :Part 1 | ISO 7396-1:2016 | Medical Gas Pipelines Systems : Part 1 Pipelines Systems for Compressed Medical Gases and Vacuum |
| IS/ISO 7396 :Part 2 | ISO 7396-2:2007 | Medical Gas Pipeline Systems : Part 2 Anaesthetic Gas Scavenging Disposal Systems |
| NIL | ISO 3746:2010 | *Acoustics — Determination of sound power levels and sound energy levels of noise sources using sound pressure — Survey method using an enveloping measurement surface over a reflecting plane* |
| NIL | ISO 5359:2014 | *Anaesthetic and respiratory equipment — Low-pressure hose assemblies for use with medical gases* |
| NIL | ISO 8573□1:2010 | *Compressed air — Part 1: Contaminants and purity classes* |
| IS/ISO 9170 :Part 1 | ISO 9170□1:2008 | *Terminal units for medical gas pipeline systems — Part 1: Terminal units for use with compressed medical gases and vacuum* |
| IS/ISO 9170 :Part 2 | ISO 9170□2:2008 | Terminal Units for Medical Gas Pipeline Systems, Part 2 Terminal Units for Anaesthetic Gas Scavenging Systems |
| IS/ISO 10524 :Part 1 | ISO 10524□1: | Pressure Regulators For Use with Medical Gases Part 1 Pressure Regulators and Pressure Regulators with Flow-Metering Devices |
| IS/ISO 10524 :Part 2 | ISO 10524□2:2005 | *Pressure regulators for use with medical gases — Part 2: Manifold and line pressure regulators* |
| IS/ISO 10524 :Part 3 | ISO 10524□3: | Pressure Regulators for Use with Medical Gases Part 3 Pressure Regulators Integrated with Cylinder Valves |
| IS/ISO 10524 :Part 4 | ISO 10524-4 | Pressure Regulators for Use with Medical Gases Part 4 Low-pressure Regulators |
| NIL | ISO 11197:2004 | *Medical supply units* |
| NIL | ISO 14644□1:1999 | *Cleanrooms and associated controlled environments — Part 1: Classification of air cleanliness* |
| NIL | ISO 14971:2007 | *Medical devices — Application of risk management to medical devices* |



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|---|---|---|
| IS/ISO 15001 | ISO 15001:2010 | *Anaesthetic and respiratory equipment — Compatibility with oxygen* |
| IS/ISO 15002 | ISO 15002:2018 | Flow-Metering Devices for Connection to Terminal Units of Medical Gas Pipeline Systems |
| NIL | ISO 17672:2010 | *Brazing — Filler metals* |
| NIL | ISO 18082:2014 | *Anaesthetic and respiratory equipment — Dimensions of non-interchangeable screw threaded (NIST) low-pressure connectors for medical gases* |
| NIL | ISO 21969:2009 | *High-pressure flexible connections for use with medical gas systems* |
| NIL | ISO 29463□1:2011 | *High-efficiency filters and filter media for removing particles in air — Part 1: Classification, performance testing and marking* |
| NIL | ISO 80601□2-69:2014 | *Medical electrical equipment — Part 2-69: Particular requirements for basic safety and essential performance of oxygen concentrator equipment* |
| IS 11478:2018 | IEC 60601-1-8:2006 | *Medical electrical equipment — Part 1-8: General requirements for basic safety and essential performance — Collateral standard: General requirements, tests and guidance for alarm systems in medical electrical equipment and medical electrical systems* |
| IS 2825:1969 | EN 286-1:1998 | *Simple unfired pressure vessels designed to contain air or nitrogen — Part 1: Pressure vessels for general purposes* |
| IS/ISO 15223 :Part 1 | ISO 15223-1:2016 | *Medical Devices - Symbols to be used with Medical Device Labels, Labelling and Information to be Supplied Part 1 General Requirements* |
| NIL | EN 1254-1:1998 | *Copper and copper alloys - Plumbing fittings - Fittings with ends for capillary soldering or capillary brazing to copper tubes* |
| NIL | EN 1254-4:1998 | *Copper and copper alloys - Plumbing fittings - Fittings combining other end connections with capillary or compression ends* |
| NIL | EN 13348:2008 | *Copper and copper alloys — Seamless, round copper tubes for medical gases or vacuum* |
| IS/ISO 10079 :Part 2 | ISO 10079-2:2014 | Medical Suction Equipment Part 2 Manually Powered Suction Equipment |
| IS/ISO 10079 :Part 3 | ISO 10079-3:2014 | Medical Suction Equipment Part 3 Suction Equipment from a Vacuum or Pressure source |
| IS 8382:1977 | | Pressure Regulators, Pre-set Used with Medical Gas Cylinders |
| IS 5355 | | Oxygen flowmeter (dry bobbin type for Therapy purposes) |
| IS 6207 | | Trolleys for Oxygen Cylinders |
| IS 3624 | | Pressure and Vacuum Gauges |
| IS 2379:1990 | | Colour code for identification of pipe lines |



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12 In addition, reference can be made to any of the following standards for clarification. Whenever, any clarification from below listed standards will be made operative, prior written consent of Project Engineer or the Hospital Consultant shall be obtained.

12.1 British Health Technical Memorandum 02-01, Part A & B Medical Gas Pipeline System Installation

12.2 British Health Technical Memorandum 08-03: Bedhead Services

12.3 NFPA 99 C (PMG Installations)

13 **Please Note** that all these standards also refer to a large number of other standards which relate to various components as used in MGPS Installation, starting from Electrical Supply, its components, etc. to the Gas Sensors, Gas Alarms, Pressure Sensors, Switches, Isolation Valves, Pipe Components, Control Valves, etc. All these need to be complied to. This, in turn, requires other standards relating to electrical safety, explosives, fire safety, etc. to be applied to the installation.

14 The terminal units for each service should be so designed that apparatus for any other service cannot be connected to them.

15 It is assumed that the Employer will take adequate medical, nursing and administrative action to minimise the dangers that may arise from misuse of the installations. The Employer will ensure that a MGPS policy is implemented and no work, however minor, may be undertaken on any part of the installations without the knowledge and permission of the designated Responsible Officer. (Sample Hospital specific MGPS policy is appended for information In Part 4.)

16 Since all Government Hospitals are being re-modelled, this MGPS Installation will be so designed that it can add 10% - 20% more MGPS outlets in future. It may provide branch circuits terminating in valve blinded off, wherever appropriate.

## DRAWINGS

17 Drawings, as provided constitute Preliminary Drawings, and represent Employer's proposal for the proposed work. These drawings provide general guidance and broadly indicate the work to be carried out, showing the areas in the Hospital Building Blocks to be provided with MGPS Outlets and the space allocated for Plant Room of MGPS Installation in the Hospital campus. Since it is a technical installation; these drawings are not meant as working drawings. The Equipment and pipe layouts, as shown on the drawings, represent a feasible scheme. Apparatus may be re-arranged in the space allocated as per the design of the successful bidder, subject to the approval of Project Engineer or Hospital Consultant.

18 The successful bidder shall then prepare detailed working drawings so as to provide a complete MGPS Installation and get these drawings approved from the Project Engineer and Hospital Consultant. Approval of the drawings by the Project Engineer shall not relieve the bidder of any part of his obligation to provide a complete MGPS Installation which works satisfactorily. The bidder shall be responsible for all alterations of the works due to discrepancies or omissions in the drawings or other particulars supplied by him, whether such drawings have been approved by the Project Engineer or not.

19 Before proceeding with the work, the successful bidder shall submit for approval, general layout and assembly drawings and such additional assembly and subassembly detailed drawings as necessary to demonstrate fully that all parts of the MGPS Installation to be furnished will conform to the specifications.

20 The successful bidder shall furnish, for check and scrutiny, three (3) advance sets of all prints of the layout, assembly and erection drawings for final approval. All drawings necessary for assembly, erection maintenance, repair and operation of the equipment shall be furnished.



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21 The successful bidder shall furnish Five (5) final sets of all drawings, based on approval accorded by the Project Engineer and Hospital Consultant. No modifications shall be made in the drawings after they have been approved by the Project Engineer without his prior consent.

22 Four copies of operation and maintenance manuals of the MGPS Installation shall be provided after approval of the detailed drawings.

23 Three sets of as built drawings shall be submitted.

24 Basic Design Information, Commissioning Results, Validation Reports, full information as to their designed mode of operation and recommended maintenance procedures shall be provided by the successful bidder, as part of the handover documentation.

## GUARANTEE

25 The successful bidder shall guarantee that all equipment supplied in this MGPS Installation is new, tested and complies with stated standards. All required Certificates, OEM certificates and manuals shall be provided to the Employer.

26 The successful bidder shall guarantee that performance of equipment individually shall not be less than the specified ratings when working under the operating conditions given for respective items.

27 It shall be guaranteed that all equipment shall be free from any defect due to defective materials and/or bad workmanship and that the equipment shall operate satisfactorily.

28 The performance and efficiencies of the equipment, individually and as a whole, shall be valid for a minimum period of thirty **six (36) months after taking over and issue of certificate of completion.** Any parts found defective shall be replaced free of all costs by the manufacturer or the successful bidder. This period shall be reckoned from the date Project Engineer certifies the virtual completion of installation.

29 The services of bidder's personnel, if requisitioned during this period, for any rectification of any defect shall be made available free of cost to the Project Engineer.

30 If the defects are not remedied within a reasonable time, the Project Engineer may proceed to do so at the successful bidder's risk and cost.

## MAINTENANCE & TRAINING

31 The successful bidder shall carry out all routine and special maintenance of the equipment and all associated works in this MGPS Installation for a period of 12 (twelve) months after the installation is taken over by the owner plant and attend to any difficulties and defects that may arise in the operations.

32 Proposal for operation and maintenance shall be submitted as a yearly contract after year one of virtual completion and for operating the installation for a period of three years extendable to ten years.

33 For smooth and better life of MGPS equipment's, 5 year operation and maintenance contract should be considered and allotted at the time of handing over of entire system.

34 5 year AMC/CMC, operation and maintenance should be done by the ultimate user, for which rates shall be decided at the time of tender and informed to ultimate user / client.

## AS PER MGPS POLICY FOR GOVT. HOSPITALS, FOLLOWING SHALL BE IMPLEMENTED

35 It is required that the Carbon Dioxide Gas source manifold be installed in a separate room near the OT room. This room will not have any other gas source. **(AS PER REQUIREMENT)**

36 The Carbon Dioxide Gas Cylinders, both empty and filled shall be stored in a separate room near the OT room. This room will not store any other gas Cylinders. **(AS PER REQUIREMENT)**

37 This MGPS Installation shall be provided Automatic Changeover Units on its manifold of cylinders to enable continuous supply of gas on low cylinder pressure.

38 The pumps for Medical Air and Medical Vacuum shall be calculated on a quadruplex (4 Number), cascading duty arrangement, operated in a sequential manner to achieve redundancy as well as energy saving.

39 MGPS system for Govt. Hospitals should be totally indigenous. It will have all its system components, which have been manufactured in India. If any component is not manufactured in India but is considered essential for completing the installation or for its

stated performance, these shall be permitted to be used after prior approval has been obtained from the Project Engineer or the Hospital Consultant.

40 Filter Assemblies, as used in Medical Air Plant and in Medical Vacuum Plant and their accessories, which are manufactured outside India may be used to achieve the stated quality of Medical Air and to provide adequate safety for prevention of Noso-comical infections.

41 Copper Pipe Fittings, as required for jointing in pipe carcass, shall meet EN 1254 – 1 ( EN Standard for copper tube and fittings) Copper Pipe Fittings which are manufactured outside India may be used to achieve the stated quality.

42 All bed Head panels and pendants for Operating Rooms shall be the type, which have been manufactured in India.

43 For Laparoscopy procedures, the Trolley mounted unit shall be used. If required, a third arm in OT Light may be added to carry the Laparoscopy Monitor.

44 Provision shall be kept in the Manifold Room for adding Liquid Oxygen or Oxygen Generator (Concentrator) at a later date.

45 The MGPS installation will meet the requirements of NBC 2016 , Part-IV, Fire Service Act and Rules.

46 The MGPS Plant Room, Manifold Rooms and the Medical Gases Cylinder Stores will be provided with Smoke or heat detector heads as part of Hospital's Fire Detection System Policy and will be provided with adequate Fire Fighting Systems & Equipment.

## DEFINITIONS

47 **MEDICAL GAS**
Any gas or mixture of gases intended for administration to patients for anaesthetic, therapeutic, diagnostic or prophylactic purposes.

48 **MEDICAL GAS PIPELINE SYSTEM**
Complete system which comprises a supply system, a monitoring and alarm system and a distribution system with terminal units at the points where medical gases or vacuum are required

49 **SOURCE OF SUPPLY**
Portion of the supply system with associated control equipment which supplies the Pipeline Distribution System

50 **PRIMARY SOURCE OF SUPPLY**
Portion of the supply system which supplies the Pipeline Distribution System

51 **SECONDARY SOURCE OF SUPPLY**
Portion of the supply system which supplies the Pipeline Distribution System in the event of exhaustion of or failure of the primary source of supply

52 **RESERVE SOURCE OF SUPPLY**
That portion of the supply system which supplies the complete, or a portion(es) of the Pipeline Distribution System, in the event of failure of (exhaustion of both the primary and secondary sources of supply.

53 **DIVERSITY FACTOR**
This factor represents the maximum number of terminal units in a defined clinical area which are likely to be used at the same time, at defined flow rates. It is expressed as a percentage of installed number of terminal units.

54 **DUPLEX**
A system which has two principal elements or parts

55 **TRIPLEX**
A system which has three principal elements or parts

56 **QUADRUPLEX**
A system which has four principal elements or parts

57 **SEQUENCING CONTROL**
The term is used in context of Pump installations where individual pumps are used in a sequential manner. It means when required, first pump no. 1 of 4 pumps is started and second time the pump no. 2 of 4 pumps is started and so on. It can also apply to a group of pumps stating at the same time when Group No. one is started first time and Group No. two is started second time and so on.
This prolongs useful life of pumps by sequencing their duty time.

58 **CASCADING CONTROL**



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Cascading Control is used in context of Pump installations where more than one pump from a group of pumps can be started to meet a design condition simultaneously. The cascaded control is built in the Control Panel. This provides energy saving and prolongs useful life of pumps by matching pump duty to required design parameters which vary in proportion to Hospital activity variation.

## QUALITY REQUIREMENTS FOR MEDICAL GASES AND AIR

59 Medical Gases supplied from cylinder or liquid sources must comply with the appropriate sections of the current edition of the Indian Pharmacopoeia.

60 The quality specification for medical and synthetic Air, and oxygen-enriched air produced from a pressure swing adsorber (PSA) system, should also comply with the appropriate sections of the current edition of the Indian Pharmacopoeia or European Pharmacopoeia.

61 All ward suction units will incorporate a suitable Bacterial Filter (minimum 0.1 micron pore size) otherwise a local suction machine shall be used. This requirement shall be generated by the Employer and verified by the MGPS Installer.

62 The above 3 conditions are the responsibility of the Hospital pharmacist through the Employer, but the MGPS Installer will co-ordinate these provisions.

63 Bacteria filters must be included in Medical Air Supply Systems to reduce the risk of delivering infectious material to vulnerable patients. Further, Micro-organisms can penetrate a bacteria filter if the material is wet. Therefore it is essential that provision for checking the dryness of air supplied to a bacteria filter be made. This is the direct responsibility of the MGPS Installer

64 Medical air shall be filtered to maintain the particulate contamination below the level provided by ISO 8573-1:2001.

## GENERAL DESIGN PARAMETERS

65 The Design of this MGPS Installation must:

- 65.1 Ensure Quantity of Supply
- 65.2 Ensure Identity of Supply
- 65.3 Ensure Continuity of Supply
- 65.4 Ensure Quality of Supply
- 65.5 Ensure design of flow rate
- 65.6 Ensure electricity backup

66 Wherever practicable, a clearance of at least 25 mm should be maintained between each MGPS service.

67 A clearance of at least 150 mm shall be maintained between MGPS service and any pipe carrying Host Water or steam.

68 All MGPS service pipes shall be electrically bonded to main earth, at building entry and exit points.

## ELECTRICAL SUPPLY TO MEDICAL GASES INSTALLATION

All electrical requirement as below shall be provided by hospital department as may be required below:

69 The Plant Room and Manifold Room will be provided with adequate Essential Electrical Supply, as defined in IEEE Std. 446, directly from the Electrical Panel Room of the

Hospital and terminated in a 4 pole isolator. (It is Primary Power Supply backed with a secondary power supply)

70 The size of Breaker required shall be calculated and informed at the commencement of works.

71 From this point, MGPS installer shall carry out all needed electrical works. The handing over documentation of MGPS installation will include a "AS BUILT" electrical layout for the whole installation.

**72 Earthing**

72.1 Adequate number of earth conductors must be provided to Ground the pipe carcass, all pumps and other electrical installation as per CPWD General Specifications for Electrical Works manual 2013.

72.2 MGPS pipes shall not be used as Earthing medium at any place.

72.3 Hospital electrical department shall provide all needed works to provide all earthings.

## GENERAL FIRE SAFETY

73 The MGPS installation will meet the requirements of NBC 2016 Part -IV Fire Service Act and Rules.

74 The MGPS Plant Room, Manifold Rooms and the Medical Gases Cylinder Stores will be provided with Smoke or heat detector heads as part of Hospital's fire detection system and will be provided with adequate Fire Fighting Systems.

## SIGNAGE

75 All Operational, Directional and safety signage shall be provided.

76 The Warning Signs, illustrative Graphics and Signs shall be in English and Hindi either on the same panel, plate, poster, etc.

77 The identification plates shall be in English only and shall be white plastic plates engraved with black letters and screwed on to various Equipment, Components, Housings, etc.

## COMMISSIONING AND HANDING OVER

78 MGPS Commissioning includes following activities to be carried out in the stated order.

79 The testing procedures as described in the IS ISO 7396-1 Standard and HTM 02-01: Medical Gas Pipeline Systems will be followed. A record shall be made of all tests performed and results. All testing shall be witnessed by the Project Engineer.

80 All errors found during testing must be rectified, and the relevant systems must be retested as appropriate before the records are signed. All such repairs must be authorised specifically by the Project Engineer and a record be maintained.

81 The MGPS Installer will provide labour, materials, equipment, Instruments, Tools and Tackle to carry out these tests.

82 The MGPS Installer will co-ordinate with Test laboratories for testing gas specificity.

**In this MGPS Installation, no MGPS Accessories or Devices which require Gas Service shall be connected to the Installation, till the Project Engineer has certified the MGPS System to be a Commissioned System**

**83 Pipeline Carcass**

83.1 Labelling and Marking
83.2 Sleeving and Supports
83.3 Physical Plant & Pipe Accommodation
83.4 Signage including Construction Safety Signage
83.5 Pipe Leakage Tests (First stage)



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83.6 Valve Leakage Tests
83.7 Cross-connection Tests

**84 Pipeline System Complete – System Test**
(with Installed Terminal Units for safe Performance with test Gases)

84.1 Leakage Tests (Second stage)
84.2 AVSU/CCB/TU/NIST Identification, Function & Performance Tests
84.2.1 Closure of CCB/AVSUs and LVAs
84.2.2 Zoning of AVSUs
84.2.3 Terminal Unit Identification
84.3 Cross-connection Tests
84.4 Pipeline System Performance Tests
84.4.1 Flow and pressure drop at individual terminal units
84.5 Supply System Performance Tests
84.6 Safety Valves Performance Tests
84.7 Alarm Systems Performance Tests
84.8 Purging with Test Gases
84.9 Particulate Contamination Tests
84.10 Vacuum Disposal System

**85 MGPS System Complete with specific Medical gases**

85.1 Purging with Working Gases
85.2 Carry out Gas Identity and Quality Tests

**86 Handing Over Documentation**

86.1 Check all OEM Manuals and Certificates
86.2 Third Party Quality Control and validation certificate shall be submitted at the time of handing over (by NABL authorised laboratory)
86.3 Installation certificate.
86.4 Check LMO License
86.5 Check DFO NOC
86.6 Check Maintenance Manual
86.7 Check all "As Built" drawings
86.8 Check all "As Installed" Equipment drawings
86.9 Check Electrical Installation Drawings
86.10 Remove Construction Labels
86.11 Check Safety Signage
86.12 Record Pressures immediately prior to commissioning

**86.13 As Installed Drawings:**

86.13.1 A separate set of "as-installed" mechanical drawings which show the actual locations of the pipelines, the diameters of the pipelines, shut-off valves (including their identification, as appropriate) and all other components shall be maintained during construction, and shall be brought up to date as changes are made. These drawings shall include details which will enable buried or concealed pipelines to be located.

86.13.2 A complete set of "as-installed" drawings of the pipeline system as specified aboveshall be presented to the healthcare facility for inclusion as part of the permanent record of the pipeline system.

86.13.3 **Electrical diagrams:** Electrical diagrams for the components supplied shall be provided by the system manufacturer to thehealthcare facility.

**87 System Commissioned**

## VALIDATION AND VERIFICATION

11. The following test parameters must be met to functionally validate this MGPS Installation. These are in addition to other physical and safety testing that is carried out.
12. All validation tests shall be witnessed by the Project Engineer and test reports verified.
13. The MGPS Installer shall provide all instrumentation for the functional tests along with their Calibration certificates.
14. The LMO system shall not be tested under no flow conditions.

15. In this MGPS Installation, the test gas shall be Compressed Air supplied in Cylinders, or generated by the Medical Air Plant, provided the Medical Air has been tested as complying to IP or EP or USP. Non-medical compressed air, from any source – cylinders or portable compressors, shall not be used.
16. When employing Medical Air Plant Compressors for this testing, the total flow under test shall not be more than 75% of the flow capacity of the dryers. This will be worked out before testing and approved by the Project Engineer.
17. The testing shall be carried out in three stages as under and as listed in detail above.
18. Tests and checks on the pipeline carcass.
19. Tests and commissioning of the complete pipeline system (with terminal units installed) for safety, performance and particulate contamination using test gas.
20. Only after tests for particulate contamination are validated, filling of the MGPS gas delivery systems with specific gases for the purposes of identity and quality tests of the specific gases will be done, prior to its use for patient care.
21. After the testing and validation, if MGPS is not to be commissioned, the pipeline will remain filled with test gas under pressure, till it is commissioned when respective gases shall be filled and identity tests and quality tests of the specific gases repeated.
22. Always, the designated Authorised Person (MGPS) isresponsible for the day-to-day management of theMGPS, after commissioning of this MGPS Installation. This shall be included in this contract agreement. All works including maintenance works and repair works, modification works, addition or deletion of terminal units, etc. must be authorised before these works are carried out.
23. All new terminal units will be supplied with "Do not use" labels. These labels shall remain in place until the final identity and quality tests have been completed. They shall then be removed by the Authorised Person (MGPS).
24. The operators, whether in house or third party, will always work under the designated Authorised Person (MGPS).
25. The results of all tests must form part of the permanent records of the hospital and should show details of the services and areas tested.

**Pressure during Pipeline System Tests**

| MEDICAL GAS | Nominal pipeline distribution pressure | Test flow (measured at terminal unit outlet) | Test location | Min. pressure at design flow measured on the test gauge | Plant pressure |
|---|---|---|---|---|---|
| | (kPa) | (L/min) | | (kPa) | (kPa) |
| O2 | 400 | 100 | Operating Rooms (ORs) | 380 | 430–490 |
| | | 10 | All other Terminal Units | | |
| N2O | 400 | 15 | All Terminal Units | 380 | 430–490 |
| Medical Air 4 | 400 | 80 | All Terminal Units | 380 | 430–490 |
| Vacuum | 55.3 (400 mm Hg) below standard atmospheric pressure of 101.3 kPa (760 mm Hg) | 40 | All Terminal Units | 400 (300 mm Hg) | 550–650 mm Hg (typical plant operating range) |

## SPECIFICATIONS OF MGPS SYSTEM (Medical Gases + Manifold & Vacuum System)

The bidders must be able to offer an integrated medical gas management system as specified in the tender documents and not only traditional medical gas piping systems. The system should have a state of the art medical gas management system.

The bidder must offer goods complying with only one international standard specific to them standard specified in the tender document and the BOQ. Offers containing products of single international standards only, if bidder quote standards goods then the bidders will be technically

disqualified. The technical specifications for the functionality of the system are prime criteria for the system design and implementation and the specified standards are the operating guidelines for the compliance and certification purpose. The bidders must offer products strictly complying with the minimum specifications as specified in the tender documents. The offers from the bidders should not contain any alternate items or optional items for any of the products whatsoever, the products complying with the specifications should only be offered.

No other references whatsoever to any other recommendations, guidelines, consulting documents would be considered except for the defined international standards mentioned against each of the products. In the financial bid must contain separate prices of all the equipment's / devices / systems and the accessories specified in the specifications against each of the said equipment's / devices / systems.

For any discrepancies / confusions in technical specification the **ISO 7396-1 (Latest Amendment)** standards will supersede and will be accepted as final.

## PART-A (GAS PLANT EQUIPMENTS)

### 1. COMPRESSED MEDICAL AIR SYSTEM

**FEATURE**

- Breathing air package incl. absorption dryer, pre- and after filter and automatic level controlled condensate drain.
- Guaranteed and validated separation efficiency according to standards.
- All dryers are in cabinet construction.
- Display of the operating status by LED.
- Optimal adaptation and generous dimensioning of the components.

**1.1 Air Compressor**

The design of medical air plant shall fully comply with the requirement of HTM 02-01/ISO 7396 for flow of as per BOQ requirement.

Medicalqualityairshallbedeliveredatanominalpressureof400kPa(4bar)or 700kPa(7bar)gaugefor supplyofthe hospitalmedicalairandsurgicalair. Themedical air plant shall deliver both medical and surgical air with minimum total flow rate As BOQ Compressor plant should be designed in such a way that compressor will switch on in a sequential manner as per flow demand. Oneormoreidenticalaircompressors/Modulesshouldruntoprovide a primary flow rate and one or more or more compressor modules to provide as standby.
The compressors should be standalone ones with independent power supply. It shouldcomplywiththe HTM 02-01/02-01/ISO 7396-1. Each compressor should be suitable for both continuous and frequent start/stop operation at a nominal plant pressure of 8 bar or more shall be provided.

**1.2 Air Receiver**

Totalairreceivercapacityshallbeas per BOQ or at least 50% +/-5% for theplantcapacityin1minuteintermsoffreeairdelivered atnormalworkingpressure.Eachairreceivershallbeprotectedbyapressurereliefvalve,afusibleplugandincludeapressuregaugewithisolatingvalveandadraincock. It should comply with relevant IS-2825 Standard.

The plant control and power management system shall monitor the safe operation of the plant, providing signal into the alarm system as per the requirement of the standard and hospital.

**1.3 filtration and dryer system**

In the case of oil injected compressor, each compressed air system shall be fitted with a multistage air/oil separator, capable of limiting oil carry over to a maximum of 3 ppm to minimize contamination and maintenance.
Duplexdesiccantdryerandfiltrationmodulesshallbe providedwiththreeindividualstagesoffiltrationasfollows:
Stage1:Coalescingfilterupstreamofthedesiccantdryerforremovingliquidwater,oilandoilaerosoldown to0.1mg/cum(0.1ppm)andparticlesdownto1micron.
Stage2:Particulatefilterafterthedesiccantdryerfordustprotectionandremovingparticlesdownto 01micron.
Stage 3:filterforremovingparticlesdownto0.01micron.

Bacteria filter:- Duplex bacteria filter system for removing particles down to 0.01 micron and preventing bacterial contamination.

**1.4 Air Pressure Reducing Station**

Pressure Reducing Station for **4 bar and 7 bar** should fully comply and meet with the requirements of thestandard. Simplex pressure reducing station shall comprise as inline pressure regulator, with downstream pressure gauge Isolation valves and pressure release valves should be provided as per the standard.Duplex pressure reducing station to have two branches, connected to the MGPS in parallel in order to allowmaintenance on the components of one branch, while the gas flow is maintained in the other branch.

Ball Valves - Full bore which operate from fully open to fully closed position with a quarter turn of the handle. Complete pressure reducing station with base plate mounted for ease of installation.Padlocks available to allow locking of the valves in both open and closed positions and must have easy to readpressure gauges. Base plate mounted and supplied with copper stub pipes for ease of installation using inertJointing procedures.

**The compressor system should have-**

- Intake filter
- Check Valve
- Delivery pipe
- Mounting on air tank along with all standard fittings viz. safety valve, pressure gauge, delivery valve, drain valve etc.
- Bidder shall provide all electric control panels, starters etc required for proper functioning of motor.
- Desiccant Air Dryer – 2 nos.
- 3-Stage Breathing Air Filters – 2 sets
- Bacteria filter for air – 2 nos.

Outlet pressures for drills/equipment and ventilators should be a minimum of7bar and 4 bar respectively.
The compressor should be heavy duty, reliable with long MTBF. Each compressor cylinder is to be protectedby a temperatureswitch, which will stop the drive motor and provide an alarm signal in the event of abnormal discharge air temperature.Each compressor module should include an inline filter with particle retention of10 microns, inlet isolation valve, discharge isolation valve, and pressure relief valve. The capacity should be capable to take care of total load of all the outlets.

**1.5 System Controls**

Air plants consist of compressors, control logic with power isolators, protection circuits, PLC (programmable logic controller), information lights... Main operating logic is controlled by PLC and pressure transmitter. In case of failure of primary control logic, backup circuit with differential pressure switch takes over control on operation.

In normal operation one compressor is "duty" others are on "standby". When required duty compressor run as long as set pressure is not reached. After 1 working hour second compressor takes over and the first one goes in standby. Program is set the way that working hours of all compressors are equalized over the time.

In case of failure on duty compressor, second one takes over and become duty.

In case of failure on primary logic (PLC, transmitter, DC supply), backup circuit with pressure switch start the compressors. To assure that two or three compressors never start at the same time there is start delay on the second and third one. Pressure value to start compressor over pressure switch is set little a lower then transmitter so two logic do not disturb each other.
Control unit is factory tested with default working parameters. Certain parameters can be changed on PLC by entering setup menu.

**PARAMETERS THAT CAN BE CHANGED:**

- LOW PRESSURE LIMIT COMPRESSOR START
- HIGH PRESSURE LIMIT COMPRESSOR STOP

- WORKING HOURS FOR DUTY COMPRESSOR
- TIME BEFORE SECOND COMPRESSOR ASSIST FOR EACH COMPRESSOR

Air plant control unit have volt-free, normally closed contacts rated at 250V AC / 2A, which can be transmitted to the central alarm system. Contacts are closed in normal operation and open when alarm conditions occur.
There are contacts for:
- COMPRESSOR FAILURE,
- SYSTEM FAULT,
- PRESSURE FAULT.

### 1.6 Accessories

Accessories including for job site installation such as inlet and discharge flexible connectors,vibration mountin g pads, and sourceisolationvalveshouldbesupplied.

## 2.0 Medical Vacuum Plant

*OPERATION AND INTENDED USE*
The purpose of this station is production and storage of vacuum in hospitals, labs and industry. The stations are fully automatic. A time relay regulates the vacuum pump working in this way to let them work alternately in time intervals. At the time of an exceeded consumption automatically also idle vacuum pump is put in gear. The vacuum pumps are set up in the way to enable always the repair and the cleaning.

| COMPONENT | DESCRIPTION |
|---|---|
| CONTROL BOARD UNIT | Control unit of the station is intended to control and monitoring the activity of the vacuum station system. It consists of electrical, electronic and measuring units and the control for the vacuum pump unit activity. At the HTM version the additional vacuum pump control unit for single pump is added. It shows the single pump activity. |
| VACUUM PUMP | This unit is intended to generate vacuum for the use in medicine. It consists of two or three equal vacuum pumps. It can vacuumise to max. 737mm (29" Hg)<br>The pump has non-return valve system for its protection. |
| VACUUM VESSEL | Vacuum vessel maintain the vacuum. |
| BACTERIAL VACUUM FILTER | Vacuum filter protects the mechanical part from contaminants like bacteria, dust and similar particles. The fluids drain in to the flask below the filter. The filter is mounted on the suction side of the system. |
| PRESSURE SWITCH | Pressure switch is a part of the signalling system. They are built in on critical pipeline measuring points. By vacuum under exceeding the switch send the signal to the signal unit in the main board. |
| PRESSURE TRANSMITTER | The transmitter constantly sends the signals to the signal unit of the main board. By exceeding values of the pressure the alarm will activate. |
| DIRTINESS ELIMINATOR | Dirtiness eliminator is intended for secretion of particles of impurities in the vacuum system. |

**Product Description**
**Medical Vacuum System**
Medical Vacuum System should comply with HTM 02-01/ ISO 7396. The unit shall consist of electric motor driven pumps vacuum receiver, electrical control system and interconnection piping and wiring. The components shall be modularly assembled for easy service.

### 2.1 Vacuum Pump (Reciprocating)

- It should fully comply and meets with the requirements of the standard.



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- Designed flow capacity should be minimum AS per BOQ.
- The medical vacuum plant shall comprise air-cooled, oil lubricated Reciprocating vacuum pumps to provide a flow rate as per BOQ as per the relevant standard (i.e. as per HTM 02-01/ISO 7396 standard) to provide the desired flow of the hospital tomaintain a vacuum level of 450 mmHg at the plant connection point.
- The vacuum plant shall comprise four air-cooled; oil lubricated Reciprocating vacuum pumps suitable for both continuous and frequent start/stop operation at inlet vacuum levels between 500mmHg and 660 mmHg.
- The control system should normally employ automatic rotation of the lead pump to maximize pump life and ensure even wear.
- Vacuum pump inlets shall include a wire mesh filter and integral non-return valve to prevent oil suck back and pressure increases in the vacuum system.
- Each vacuum pump shall be fitted with anti-vibration pads between the pump foot and mounting frame. The plant shall be fitted with duplex bacteria filter system. Each individual filter shall have the capacity to deliver full design flow such that one set is designated duty and the other will be standby.
- Each bacteria filter shall be provided with a transparent sterilize collection jar to collect condensate.
- The total water capacity of the pressure vessels shall be at least 100% of the design flow rate of the plant in 1 minute in terms of free air or as per BOQ.
- The plant control and power management system shall monitor the safe operation of the plant, providing signaling into the alarm system as per the requirements of HTM 02-01/ISO 7396.
- Vacuum pump exhaust shall be piped out of the plant room and discharged outside the building at high level away from windows and any other air intakes.

**2.2 Pressure Switch**

Pressure switch sends signal to electric control system by which it Controls Pumps & compressor to start & stop function at a set gas pressure point.

**2.3 Vacuum Receiver**

The vacuum receiver shall be made of rust free corrosion resistant Mild steel and fabricated as per IS:2825 for a vacuum pressure of 760mmHg. It should include bypass valves, manual drain valves, vacuum gauge. Vacuum reservoir shall have total volume of at least as per BOQ at normal working pressure.

**2.4 Silencer Muffler Type**

silencer is one of the integral parts of the exhaust system of pumps. It plays its part in silencing the noise from pumps creates on the exhaust system.

**2.5Vacuum Bacterial Filters**

- The bacteria filters and drainage trap should comprise two identical sub-assemblies with manually-operated isolating valves, arranged to allow either sub-assembly to be on stream. Each sub-assembly should contain a bacteria filter rated at the plant capacity.
- The bacteria filter should be marked with the legend "bio-hazard", together with a description of a safe procedure for changing and disposing of the filters and emptying the drainage trap.
- The bacteria filters should have a filter efficiency, when tested by the sodium flame test in accordance with BS 3928:1969, of greater than 99.995% at the system design flow.
- The pressure drop across a clean filter at the system design flow should not exceed 25 mm Hg (3 kPa) at a vacuum of 475 mm Hg (63 kPa).
- The drainage trap may be integral with the bacteria filter and should be fitted with a transparent bowl to collect liquid. The bowl should be suitable for steam sterilization at 121°C.

## 3.0 OXYGEN SUPPLY SYSTEM

**3.1 Oxygen Cylinder Manifold System**

Oxygen Manifold System as per BOQ comprising high pressure copper pipe size with high pressure brass fitting made of high tensile brass. NRV and high pressure copper tail pipes. Manifold must be supplied with adequate numbers each of high NRV and pig tail pipes for isolation of each cylinder

system. The manifold should be so designed that it shall suit easy cylinder changing and positioning. The system should have non-return valves for easy changing of Cylinders and without closing the bank. The cylinder should be place with the help of cylinders brackets and fixing chains which should be zinc plated. Cylinders may or may not be in scope of gas pipe line supplier (please quote the prices/charges of the cylinders separately).

The manifold should be hydraulically tested to 3500 psig. The high pressure header bar shall be designed in such a manner that it can be extended to facilitate additional cylinder connections.
The manifold should be so deigned that it shall suit easy cylinder changing and positioning. The system should have non-return valves for easy changing of cylinders without closing the bank.

The cylinder should be placed with the help of cylinder brackets and fixing chains which zinc plated.

**3.2Change Over Reduction Box (Oxygen)**
The Oxygen change over reduction box will be of Digital fully Automatic and shall switch from "Bank in Use" to "Reserve Bank" without fluctuation in delivery line pressure and without the need for external electrical power. After the switch – over, the "Reserve Bank" shall become the "Bank in Use" and the "Bank in Use" shall become the "Reserve Bank". The Change Over Reduction Box will have Power Supply & Signaling Module. The power supply module supplies electric power to alarm system of the reduction box. The signaling module for monitoring the pressure status & will trigger an alarm, if the set limit values are exceed.

All components inside the Change Over Reduction Box like Pressure Regulators, piping and control switching equipment shall be cleaned for Oxygen Service and installed inside the cabinet to minimize tampering with the regulators or switch settings.

The Change over Reduction Box will be made of Heavy Duty sheet. The safety cover of reduction box is lifted with the help of two dampers. The capacity of reduction box at 4 bar outlet pressure is As Per BOQ and it has two working reduction valve.

The change over box is equipped with a modern LCD display, LEDs & buttons for easy menu cycling which enable a great overview & easy information monitoring. On display the following parameters can be monitored:-

Visual Light Signaling:- The light of the light emitting diodes can be seen from the distance of 4m, if the illumination of the room is between 1000 & 1500 Lx. In case of an error the LEDs blink with the frequency of 1Hz (0.5s ON – 0.5s OFF). The parameter for the blinking is adjustable.
Buttons :-The buttons are touch – sensitive.
Pressure Transmitter: - Installed in each change – over reduction box is an adjustable pressure transmitter (4 – 20 mA) with ON/OFF switching capability.
Flow Meter: - The alarm system display, with the help of aflow meter, enables or shows:

- Overview of the flow rate statistics
- Current flow rate
- Current consumption
- Monthly consumption
- Setting of the critical flow limit – THE ALARM GOES OFF
- All the values remain stored, even in case of an electrical outage

Unit must have CE notified number on it. System Comply HTM 02-01/ ISO 7396. It must be come with serial number, warranty and test certificate from European / American manufacture only

**3.3 Oxygen Emergency Cylinder Manifold System**
A separate Bank consisting of As Per BOQ cylinders which shall be connected to the main line through double stage high flow regulators after isolating the control panel to ensure uninterrupted supply of medical oxygen in case of manifold/control panel is in operative. The regulators will have gauge to show the status of standby cylinders and delivered line pressure and have safety valve set to blow at pressure above 70 PSIG.

Note: Cylinder is note in scope of supply and will be purchased separately.

## 4.0 NITROUS OXIDE SUPPLY SYSTEM

### 4.1 Nitrous Oxide Cylinder Manifold System

$N_2O$ manifold system as Per BOQ comprising of high pressure copper size with high pressure brass fittings made of high tensile brass, NRV and high pressure copper tail pipes. Manifold must be supplied with adequate numbers of high quality NRV and pig tail pipes. The manifold should be so designed that it shall suit easy cylinder changing and positioning. The system should have non-return valves for easy changing of cylinders without closing the bank. The cylinder should be place with the help of brackets and fixing chains which should be zinc plated. Cylinders will not in scope of gas pipe line supplier.

### 4.2Change Over Reduction Box(Nitrous Oxide)

Same as specification of oxygen reduction box.
The capacity of reduction box at 4 bar outlet pressure is as Per BOQ and should have two working reduction valve.

Unit must have UL Listing/CE notified number on it. System Comply HTM 02-01/ ISO 7396. It must be come with serial number, warranty and test certificate from European / American manufacture only

### 4.3 $N_2O$ Emergency Cylinder Manifold System

A separate Bank consisting of manifold system as per BOQ which shall be connected to the main line through double stage high flow regulators after isolating the control panel to ensure uninterrupted supply of medical gas in case manifold/control panel is in-operative. The regulators will have gauge to show the status of standby cylinders and delivered line pressure and have safety valve set to blow at pressure above 70 PSIG.
**Note: Cylinder is note in scope of supply and will be purchased separately.

## 5.0 MASTER ALARM& GAS SUPERVISION SYSTEM

Master gas alarm should be able to communicate with **all gases plant equipment** in manifold room/plant room. Should able to connect with LAN network as directed by EIC.(cost for LAN networking connection paid extra as required after
RESET – is used to discontinue the sound alarm
TEST – is used to control & Check the alarm
**Master Alarm configuration:**

| Oxygen Manifold | Nitrous Oxide Manifold | Air Plant | Vacuum Plant |
|---|---|---|---|
| Normal | Normal | Normal | Normal |
| Left Empty | Left Empty | Comp-1/2 Failed | Pump-1/2 Failed |
| Right Empty | Right Empty | Comp-3/4 Failed | Pump-3/4 Failed |
| Pr. High | Pr. High | System Fault | System Fault |
| Pr. Low | Pr. Low | Pressure Fault | Pressure Fault |

Unit must have CE notified number on it. System Comply HTM 02-01/ISO 7396. It must be come with serial number, warranty and test certificate from European / American manufacture only

Gas Supervision System (GSS):



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GSS (Gas supervision system) is a software, which should be able to communicate and provide Realtime data access and alarm/events from all Hardware (Manifolds, Plants, Control closing boxes). This includes interconnection all Alarms to GSS.

6.0 Electrical Control Panel for Medical Air Compressors & Vacuum Pumps

The Electrical Control Panel for Medical Air Compressors & Vacuum Pumps shall be suitable for the selected quadruplex system and will be fabricated to be a Combined Control Panel.

It will not provide any control over General Lighting and will not provide Power for Alarm Panels, Air-conditioning units or any other sub-system.

Power distribution for General Lighting. Alarm Panels, Air-conditioning units, etc. will require an additional Electrical Distribution Board. Provision of this Electrical Distribution Board is in the scope of the MGPS Installer.

The Combined Electrical Control Panel will provide cascading and sequenced control to start and stop the pumps.

The Combined Electrical Control Panel will be provided, complete with Mains Incomer, Bus Bar arrangement, Voltmeter, Hour Meters, Phase indicating lights, Single Phasing Preventer, Phase loss/Phase Reversal indicating light, individual MCBs for all starters, individual Ammeters for all motors, Contactors, Overload Relays, Control Circuit MCB, Start/Stop Push buttons, Auto/Manual switches, Pump "ON" and Pump "TRIP" indicating lights, Sequencing Relays (Separate for Air Compressors and Vacuum pumps) with overriding feature.

The Sequencing Relays must be door mounted. It should have all indications like Mains ON, Input ON, Pump Next in Turn, Pump "A"/Pump "B" ON, Pump "A"/Pump "B" Fault, etc., Audio Alarm in case of Fault and having an option of locking the sequencing arrangement on either pump.

Sequencing relay shall provide for parallel operation of all pumps or compressors, in case the need arises.

All terminals, switches and lights must be duly marked.

Internal wiring must be duly ferruled.

Incomer should be of adequate size so that it is suitable for the total load of the system.

The Combined Electrical Control Panel will provide Timer delay to ensure that both Equipment Systems do not restart simultaneously.

Rating of switches shall be as per National Electrical Code and suitable for motors, as deployed.

The Panel enclosure of the Combined Electrical Control Panel shall be powder-coated in White or Off-white Colour.

The Combined Electrical Control Panel Board for Pumps shall be housed in a protected area away from the Gas Manifold Location and it shall never be installed in the Gas Cylinder Storeroom.

The Project Engineer shall approve the detailed drawing of the Combined Electrical Control Panel Board for Pumps before its manufacture or fabrication.

PART-B (GAS DISTRIBUTION EQUIPMENTS)

7.0 Gas Terminal Unit

The medical gas terminal unit HTM compliance (should conform to ISO 9170-1:2008or above and accept probes to BS 5682) Compliance. The wall mounted first fix assembly should consist of brass pipeline termination block with copper stub pipe permanently secured between a back plate and a gas specific plate which allows limited radial movement of the copper stub to align with the pipeline.

Terminal units should be gas specific and only accept the correct medical gas probe. Gas specific components should be pin-indexed or geometric indexed to ensure that a correct gas specific assembly is achieved so that in normal course of dismantling for repair or maintenance, parts from other gases cannot inadvertently be used. Wall mounted terminal units should incorporate an anti-rotation system to engage with connected downstream medical equipment ensuring correct orientation. Terminal units installed in booms or pendants should be attached to their respective flexible gas hose by a gas specific NIST fitting and anti-rotation pins should not be fitted. Terminal units located in a rigid installation should be capable of single-handed insertion and removal of the correct medical gas probe.

Main feature of Gas outlet are as:-

Main constituent parts made of metal component

Less components used

Smooth connection and disconnection

Unit must have CE notified number on it. System Comply HTM 02-01/ ISO 7396. It must be come with serial number, warranty and test certificate from European / American manufacture only

The above specifications are in general, however as mentioned above each part should strictly meet either of theHTM 02-01/EN737/ISO 7396 ( Latest Version)

8.0 AVSU/CONTROL-CLOSING VALVE BOXES (INTEGRATED WITH AREA ALARM)

The purpose of Control-Closing Valve Boxes for medical gases is permanent status control of medical gases within the network system installed in a certain building. The boxes are installed in individual floors/area, which allows for status control of medical gases throughout the building/floors/area, and shutting-off the supply to individual parts of the building. In addition, in case of a central supply outage, they enable emergency supply to individual installation branches.

A detailed view of what is going on with an individual media is enabled by the LCD alarm system display of a rather trendy design. User-friendly menus show the decrease or increase of pressure and the flow rate of an individual medium. The temperature is monitored, as well. The REED switch detects, if the box was opened by force. The REED sensor may also be installed on the valve, giving the valve status OPEN/CLOSED. Any potential fault is accompanied by an acoustic warning and

signaled by red LEDs. These errors can also be monitored remotely using the GSS system (CAN-BUS technology) or potential-free contacts. Each box has the capacity to house 1-5 different gases, and may be either surface-mounted or sunken-mounted.

The block of the control-closing box is a connection unit for copper pipes, shut-off valve, emergency supply, pressure transmitter, pressure gauge, flow meter (optional). The box casing should be made of stainless steel sheet metal for long durability for smooth functioning & operation, the entry of inlet & outlet connection of each services should be from top side of the box.

The inlet/outlet pipes are made of copper, with a max. Diameter of Ø22 mm. Upstream from each individual block there is a shut-off valve which enables the operator to cut-off the supply to a specific section / floor of the building. The emergency supply connection port may be used in case the central supply fails. The port is installed at buyer's option. (NIST, DISS), the pressure transmitter translates the gas pressure into an electrical signal which is then relayed to the block connection module. The installed pressure gauge enables visual pressure monitoring.The optional flow meter measures the quantity of the gas flow within the gas installation system.

The valve box should have a lockable door with a 4 mm thick tempered glass installed on door should be opened for easy maintenance access. In case of any emergency, the door can be opened by force (hit the lock) without damaging the glass.

Signalling: The light of the light emitting diodes can be seen from the distance of 4 m, if the illumination of the room is between 1000 and 1500 Lx. In case of an error, the LEDs blink with the frequency of 1 Hz (0.5 s ON – 0.5s OFF). The parameter for blinking is adjustable. The LEDs give the following warnings:

ALARM SYSTEM DISPLAY CONNECTION FAILURE/

ON/ OFF ALARM DISPLAY FAULT

PRESSURE TOO LOW

PRESSURE TOO HIGH

NORMAL PRESSURE

The alarm system incorporates a touch sensitive display which enables easy "Menu cycling", and with the help of a flow meter (optional), enables or shows: Overview of the flow rate statistics, Current flow rate, Current consumption, Monthly consumption, and at the time of setting of the critical flow limit – THE ALARM GOES OFF and all the values remain stored, even in case of an electrical outage.

It should be compatible with Gas Supervision System through CAN-BUS / IP protocoland then it can be connect all hardware to one software- Building Management System through OPC-server.

Unit must have CE notified number on it. System Comply HTM 02-01/ISO 7396. It must be come with serial number, warranty and test certificate from European / American manufacture only

9.0 BED HEAD UNIT

It should provide a safe efficient means of delivering services to patients staff in both general and special care applications, it is modular design made of high strength extruded Aluminum with anodized finish, and ability to house medical gas terminal units ( as per Requirement) and electrical socket , smooth curved surfaces, no visible screws and choice of colored decor stripe, ease of installation via separate rail-bracket or wall mounting plates, easy removal of covers for maintenance and pipeline connection, with medical rail as part of the modular extrusion design.

Construction: Body manufactured from extruded aluminum alloy profile having thickness not less than 2 mm conforming to 6063-T6 (ISO:AlMg0.5Si) for strength & excellent finish. Internal compartments for separation of different services i.e. Gas, Power& Communication. It should be epoxy coated and aesthetically coloured to RAL 7035 Textured. Average coating Thickness 60 to 80 microns shall be ensured.

Moulded ABS End Covers for symmetrical design.

Overall Dimensions: 900-1200 mm X 170 mm X 80 mm (L X W X H) ( AS PER BOQ)

Equipotential groundarrangement

Ingress Protection – IP 54

Anti bacterial design.

Hassle free service of components from the front with ease without removing the unit from its anchor.

No fastener shall be visible when viewing from front to maintain aesthetic.

The unit shall comply with the requirements of HTM 08 – 03,BS EN ISO 11197: 2016, BS EN ISO 9170 – 1: 2008 & MDD Class 1 – 93/42 EEC.

SeparateMedical Rail for parkingequipmentto provide efficientpatient care services. Rail manufactured from solid Aluminum alloy conforming to 6063-T6. Extruded to specially designed profile required to adapt "Quick Claw Clamps" for quick fixing & removal of equipment withouttools & skill. Rail shall comply with the requirements of BS EN ISO 19054 : 2006 + A1 : 2016

Its aluminum extrusions have a polyester coating finish on all external surfaces before installation. It have provision for nurse call, data or monitoring sockets, should be made at the point of manufacture .It should be supplied duly pre-piped, prewired and fully tested or in carcass form.

Each Horizontal Bed Head Panel shall be having-

Provision of gas outlet as distribution list.

Pre wired Power – One 6 amps multi standards socket + One 13 amps power socket.

One 6 amps multi standards socket + One 13 amps power socket through UPS.

Luminary - Integrated full length linear X watt LED with colour temperature of 3000 to 6000 K and Polycarbonate generallighting diffuserfor comfortable reading.

It should be 900-1200 mm long as required to fulfill user requirement.

provision for nurse call as required

Electrical connection from main supply to Bed head unit in not in part of contractor scope. It will be done by user department by its own resources. Only internal wiring within unit is in scope of contractor.

COPPER PIPING / DISTRIBUTION PIPING

Pipeline Layout Drawings

The drawings as provided are indicative of Pipe Line Routes. All bidders are expected to visit the site and prepare their bids based on actual site conditions.

All pipe layouts, either external or internal, will be adequately protected.

Pipeline Materials

Pipes used for internal or external installation and other installations carried in protective pipes, shafts, trenches, etc., shall be of medical grade copper, solid drawn, seamless, deoxidized, non-arsenical, tempered materials, designated to R220 (to be used only for Tailpipe), R250 and R290; confirming to BS EN 13348.

Pigtail connections for Oxygen shall always be of Copper.

Pigtail connections for Nitrous Oxide, Medical Air 4 and Carbon Dioxide manifolds can be of Copper or Stainless Steel, Grade 304/316, internally lined with Teflon.

All copper pipes must be inspected and certified by a Third Party Inspection Agencies like Lloyds, SGS, TUV as to their physical properties and chemical composition including cleanliness status before dispatch.

The Copper Pipes will be delivered on site, plugged or capped at both ends.

The pipes shall be accompanied with Manufacturer's Test Certificate.

Pipeline Design

The Pipeline Design and Size must take care of following parameters for all gas services in this MGPS Installation.

Desired flow rate

The Diversity Factor

The allowable friction loss for all positive pressure gases including Oxygen, Nitrous Oxide, Medical Air 4 & Carbon Dioxide will be Nil.

The Equivalent Length of Piping will be derived by adding 50% of the measured run to account for bends, fittings, etc.

Pipeline Jointing

All fittings, for example, valve and control panel fittings, will be of Medical Grade Copper and brass only. Copper Pipe Fittings, as required for jointing in pipe carcass, shall be end-feed capillary fittings which conform to EN 1254-1.

All fittings when supplied must be certified by the manufacturer to be clean and degreased. All fittings shall be cleaned and degreased before they are used, if so required.

Joints shall be made on site by silver brazing (Recommended silver copper-phosphorus brazing alloy CP 104 conforming to BS EN 1044:1999). Copper to Copper joints will be made with brazing filler rods that can be used without flux.

Where screwed joints are needed, they may be made with unsintered (de-greased) P.T.F.E. tape.

Brazing, for all positive pressure gases and for vacuum pipelines – up to and including 22 mm pipes, that are run in medical gas supply units and to individual terminal-unit drops, shall be carried out using oxygen-free nitrogen as an internal inert gas shield to prevent the formation of oxides on the inside of the pipes and fittings. Pipes shall be continuously purged with oxygen-free nitrogen with terminal flow rate of 2 litres per minute.

Pipe Size

The following pipe specifications are mandated as per EN 13348.

Wall Thickness Tolerance shall be ± 10% for tubes upto Outer Diameter of 54 mm and ± 15% for tubes upto Outer Diameter of 76 mm and 108 mm.

| Outer Diameter | Wall Thickness |
|---|---|
| 12 mm | 1.0 mm |
| 15 mm | 0.9 mm |
| 22 mm | 0.9 mm |
| 28 mm | 0.9 mm |
| 42 mm | 1.2 mm |
| 54 mm | mm |
| 76 mm | 1.5 mm |

No pipe smaller than 12 mm OD shall be used anywhere in this MGPS Installation.

No pipe smaller than 15 mm OD shall be used anywhere in this installation for the Surgical Suite including Operating Rooms & recovery Wards.

No pipe smaller than 15 mm OD shall be used anywhere in this installation for the Medical vacuum service.

Support for Pipeline

The pipeline shall be adequately supported at sufficient intervals as tabulated hereunder. The supports shall be suitably treated to minimise corrosion and prevent electrolytic action between the pipes and supports.

| OUTSIDE DIAMETER | MAXIMUM INTERVALS | MAXIMUM INTERVALS |
|---|---|---|
| (mm) | For Vertical Runs (m) | For Horizontal Runs (m) |
| 12 | 1.2 | 1.0 |
| 15 | 1.8 | 1.2 |
| 22 - 28 | 2.4 | 1.8 |
| 35 - 42 | 3.0 | 2.4 |
| >54 | 3.0 | 2.7 |

Where pipes pass through walls, partitions or floors they shall be fitted with sleeves of copper pipes and provided with appropriate escutcheon plates where to view.

The sleeves shall project a distance of 25 mm beyond the surface of penetration.

The annular space between the sleeve and pipe shall be tightly caulked with a suitable material.

Concealed pipe work shall not be sealed in until it has satisfactorily passed all visual inspections and pressure tests. Once covered, the route of the buried pipe work shall be clearly and continuously marked by chalk, coloured adhesive tape or otherwise during construction, to discourage the insertion of fixings into or near the pipe by other trades.

Due allowance shall be made in the installation for building movement at all constructional expansion joints.

The design of supports, brackets and hangers for all pipe work shall be in accordance with BS 3974.

The MGPS Installer shall co-ordinate the tie-in of pipe supports with Structural and Architectural works and shall provide additional support structures, wherever necessary.

Buried Piping Outside Of Buildings

All MGPS service pipes when provided outside of buildings shall be buried at a sufficient depth to protect the piping from excessive stresses. The potential hazard arising from this situation shall be assessed using risk analysis procedures in accordance with ISO 14971.

Temporary support, adequate protection and maintenance of all underground and surface structures, drains, sewers and other obstruction encountered in the progress of this work shall be

furnished under the direction of the Project Engineer. The structures which may have been disturbed shall be restored upon completion of the work.

The pipes shall be laid in trenches or conduits placed at least 2 M from each other.

If practical, buried underground piping can be placed in a continuous conduit, of high density polyethylene (HDPE), after obtaining approval from the Project Engineer. In such cases, the ends of the conduit sleeve shall be sealed to prevent the entrance of ground water.

If practical, underground piping shall be run in properly drained ducts not less than 450 mm x 450 mm, when crossing the roads.

All underground piping shall be provided with valves in a convenient location at either end, housed in accessible manholes or valve chambers. The valves should comprise LVAs with NIST connectors for the purposes of pressure testing and other tests.

The minimum backfilled cover above the top of buried piping outside of buildings shall be 1000 mm; except that the minimum cover shall be permitted to be reduced to 500 mm, where physical damage to the piping is not likely to occur.

Trenches shall be excavated so that the pipe has a firm, substantially continuous bearing on the bottom of the trench. Trenches will provide Sand padding of 100 – 150 mm, with suitable rock-free material.

Backfill shall be clean and compacted so as to protect and uniformly support the piping.

The MGPS Installer must get the pipe layout inspected by the Project Engineer, prior to backfill.

A continuous tape or marker shall be placed immediately above the pipe enclosure which shall clearly identify the pipeline by specific name.

The route of pipes placed underground should be indicated at the site by appropriate means, e.g. by continuous marking tape above the pipeline at approximately one-half the depth of burial, by placing proper all weather signs, etc. Further the route of the pipeline should be identified on the surface by placing proper permanent warning signs, 300 mm above the top surface, in a manner that they are clearly visible. It should be clearly shown on site layout drawings also.

Suitably placed covered Manholes or valve chambers, with removable covers, shall be provided to enable access to the joints and valves, during visual inspection and leak testing.

Identification, Marking, Colour Coding Of Pipe Lines

Pipelines shall be identified by painting them with Indian standard colours code IS 2379:1990, as under.

The Warning Signs, illustrative Graphics and Signs shall be in English and Hindi either on the same panel, plate, poster, etc.

The identification plates shall be in English only and shall be white plastic plates engraved with black letters and screwed on to various Equipment, Components, Housings, etc.



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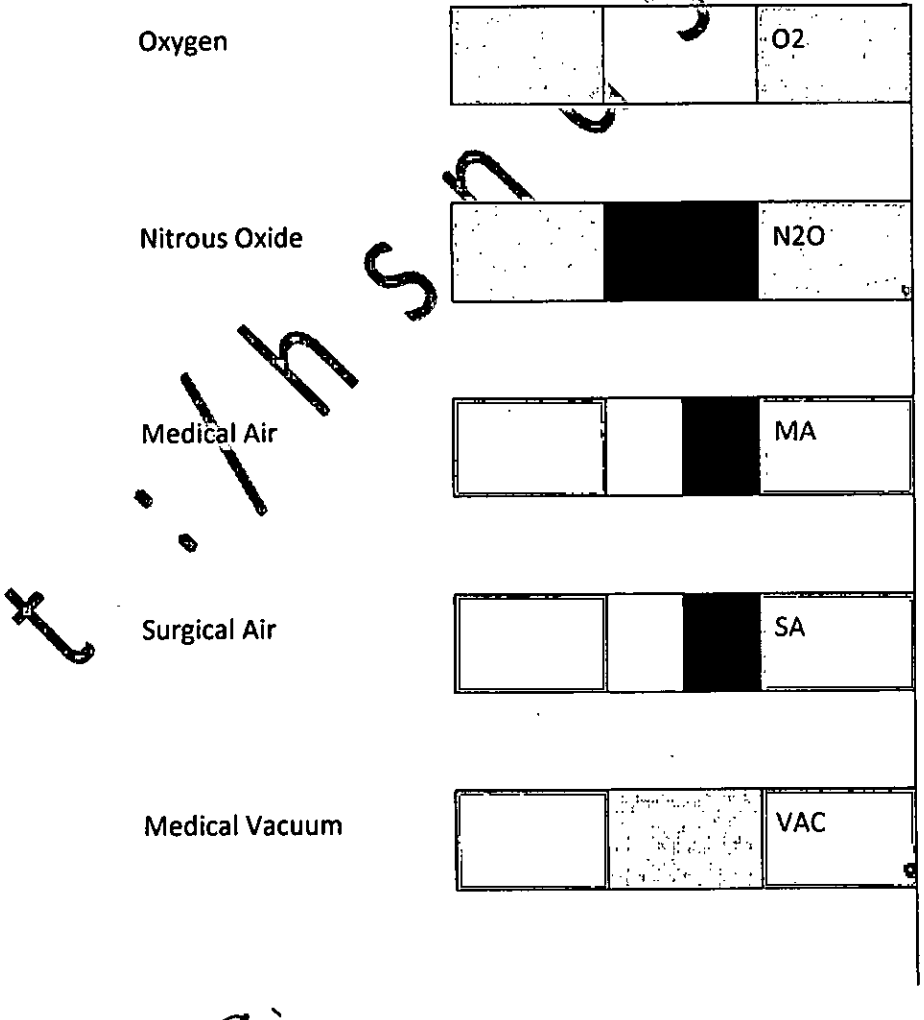
| GAS | SYMBOL | BASE COLOUR | FIRST COLOUR BAND | SECOND COLOUR BAND |
|---|---|---|---|---|
| Oxygen | OXY | Canary Yellow | White | -- |
| Nitrous Oxide | N2O | Canary Yellow | French Blue | Signal Red |
| Medical Compressed Air | AIR-4 | Sky Blue | White | Black |
| Vacuum | VAC | Sky Blue | Black | -- |

Optional Colour code of HTM 02-01 (BS 1710:1984) as under:



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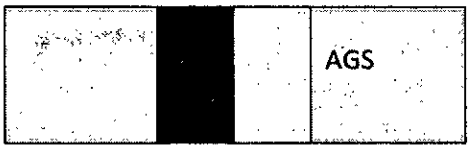
AGS System 


Pipelines should be identified in accordance with BS 1710:1984, and colour banding for the pipelines should be used. Colour band identification (see Figure 35) should be applied near to valves, junctions, walls etc.

A label applied every 3 m and bearing 6 mm size letters should identify each gas. Self-adhesive plastic labels of approved manufacture may be used for this purpose. A band 150 mm wide is usually adequate.

All colour-coded tapes applied by the pipe manufacturers should be removed before the systems are identified.

Care should be taken to maintain pipeline identification when periodical re-painting is undertaken. The direction of flow should be indicated.

TESTING

All the piping system shall be tested in the presence of the Project Engineer or his authorized representative.

Isolation valve

The isolation valves are Non Lubricated Ball type, suitable for oxygenservice. All valves has been pneumatically tested for twice the working pressure and factory de-greased for medical gas service before supply.

PART-C (MEDICAL GAS PIPELINE SYSTEM ACCESSORIES)

These consist of following units which get connected to MGPS terminal units.

OXYGEN FLOW METER WITH HUMIDIFIER

Oxygen flow meters are used to control the flow-rate of Oxygen gas drawn from the central supply system or from a compressed gas cylinder. They are typically used in all types of wards, for adult, paediatric & neonates alike. They may also be used in other areas like anaesthesia administration stations and ambulances.

This MGPS Installation will use "Ball and Pressure Dome" type flow meters. It shall provide a control knob to regulate gas flow control, within a range of 0 - 15 Litres per minute.

The flow meter housing shall be powder coated Aluminium or Chrome plated Brass. The flow meter tube or Pressure dome shall be made from Polycarbonate.

The Humidifier Bottle, Capacity 150 ml, will be re-usable type made of unbreakable polycarbonate material. It should be able to withstand autoclaving for its sterilisation.



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The procurement of Oxygen Flow Meters with Humidifier shall be as per the sample that is approved.

SUCTION UNITS

WARD VACUUM UNITS

Standard Ward Vacuum Units will provide suction in the range of 0-760 mm/hg and will be used in all adult wards & ICUs.

Standard Ward Vacuum Unit shall be a composite wall mountable unit and shall consist of following;

Water Trap with Bacterial Filter in its housing, minimum 1 micron pore size, with a 50 ml polycarbonate jar, complete with pipe adapter for connection to the Vacuum outlet. The jar will be autoclavable.

A control knob to regulate the suction flow rate (0-760 mm/hg)

A high vacuum regulator fitted with a gauge. (0-760 mm/hg)

This in turn, will be connected to a wall mounted polycarbonate collection Jar, capacity 600 ml, which is autoclavable. The Jar cover will be made from polycarbonate and will be autoclavable.

The collection Jar will be provided with automatic fluid control trap mechanism to prevent fluid spill over into the regulator.

A wall bracket for mounting.

The Jar cover and other cover plates shall be of Yellow Colour.

The procurement of Ward Vacuum Units shall be as per the sample that is approved.

LOW PRESSURE (& LOW FLOW) WARD VACUUM UNITS

Low Pressure (& Low Flow) Ward Vacuum Unit will provide suction in the range of 0-300 mm/hg and will be provided in NICU, Paediatrics, New Born Care Centres, New Born Stabilization Units and Gynae & Obstetric Operating Rooms (where required).

It is same as the Standard Ward Vacuum Unit except that the control knob to regulate the suction flow rate and the vacuum regulator fitted with a gauge will be suitable for 0-300 mm/hg.

The Jar cover and other cover plates shall be of Yellow Colour.

The procurement of Low Pressure (& Low Flow) Ward Vacuum Units shall be as per the sample that is approved.

THEATRE VACUUM UNITS

Theatre Vacuum Unit shall be trolley mounted and shall consist of following:

Water Trap with Bacterial Filter in its housing, minimum 1 micron pore size, with a 50 ml polycarbonate jar, complete with pipe adapter for connection to the Vacuum outlet. The jar will be autoclavable.

A control knob to regulate the suction flow rate (0-760 mm/hg)

A high vacuum regulator which will be step-less, adjustable and have a vacuum gauge with large display (0-760 mm/hg).

This in turn, will be mounted to a trolley which has a pair of inter-connected polycarbonate collection Jars, each with capacity of 2000 ml, through a 3-way valve. Both collection Jars will be autoclavable. The Jar cover will be made from polycarbonate and will be autoclavable.

Only one of the collection Jars will be provided with automatic fluid control trap mechanism to prevent fluid spill over into the regulator.

The Unit will be mounted on an Aluminium Trolley having four (4) free moving castor wheels, with a stable base design and a easy grip handle.

The Jar cover and other cover plates shall be of Yellow Colour.

The procurement of Theatre Vacuum Units shall be as per the sample that is approved.

MEDICAL GAS HOSES

Medical Gas Hoses, conforming to ISO 5359:2014, are used to provide a safe method for transferring low pressure Medical Gases to various Medical Devices.

The hoses are intended for operating at pressures up to 1 400 kPa and for vacuum systems at pressures not greater than 60 kPa absolute.

The Medical Gas Hoses, as supplied will be suitable for use with Oxygen, Nitrous Oxide, Medical Air 4, Medical Vacuum and Carbon Dioxide.

The Gas Supply Tubing shall be antistatic and coloured as under.

| GAS | WHITE |
|---|---|
| Oxygen | White |
| Nitrous Oxide | Blue |
| Medical Compressed Air | Black & White |
| Vacuum | Yellow |
| Carbon Dioxide | Grey |

The Gas Supply Tubing shall comprise of an inner hose and sheathing with polymer material thread reinforcement in between to ensure the required burst pressure resistance (up to 7000 kPa).

The Medical Gas Hose assemblies shall comprise a length of hose (Maximum 4 Meters) with a probe connector (BS 5682) on one end and a Equipment Connector (NIST) on other end, crimped securely. The length variation will be determined by the User.

The Manufacturing Date is to be printed on the Medical Gas Hose pipe, clearly.

ADDITIONAL WORKS

Supply of Gas Cylinders and Trolley

Supply of Medical gas Cylinders

The Bulk Type, High pressure, Medical Gas Cylinders, conforming to IS 7285, duly approved and marked with Test pressure and date of the hydrostatic stretch test shall be supplied.

All cylinders shall be Colour coded for the specific gas.

Cylinder's Water Capacity: 47 Litres

Cylinder's Gas Capacity: 7.0 cu.m

Working Pressure at 15 degree Celsius: 150 kgf / sq. cms.

Test Pressure: 250 kgf / sq. cmsMinimum supply Pressure at ambient conditions: 140kgf/sq. cms.

Valve Fittings for Compressed Gas Cylinders: IS 3224 (2002)

The procurement of Medical gas Cylinders shall be as per the sample that is approved.

Supply of Medical gas Cylinder Transportation Trolley

The Medical Gas Cylinder Transportation Trolley shall be of Robust and durable design, stable, provided with 4 wheels, suitable for a smooth ride over uneven surfaces with following Specifications. (Indicative design shown in the picture below)

The Trolley Frame shall be fabricated from Mild Steel Tubes, suitable for transporting D Type Bulk Cylinders. It will be provided with a base plate of suitable size to hold the Cylinder.

It will be provided with two (2), 150 mm Dia Polyurethane (PU) wheels, and two (2), 100 mm swivel Polyurethane castors in a manner that provides smooth ride.

It will be provided with 2 brackets, one at quarter cylinder length from the floor, second at half cylinder length from the floor, complete with Securing Chains to prevent the Cylinder from falling or tipping over, when being transported.

The handle bars will be provided with Polyurethane (PU) Grips.

The Trolley frame shall be painted using powder coated paint.

The procurement of Medical Gas Cylinder Transportation Trolley shall be as per the sample that is approved.



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Electrical Works

The Electrical Works shall include all electrical installation work of MGPS Plant Room and MGPS Apron. It shall be from the 4 Pole MCB / MCCB or the Isolator provided by PWD, onwards

It will include supply, fixing and/or installation of the following

Meter Boards/Meter Boxes

Distribution Boards, with earth leakage circuit breaker (ELCBs) and with MCBs

All points such as Light, Fan, light plug and power plug points etc.

Light Fittings of approved design and make

Security Lights of approved design and make

Ceiling Fans of approved design and make

Exhaust Fans of approved design and make

All earthling pits and conductors

Window or Split Type Air-conditioning Units

Telephone Wiring and telephone Instruments of approved design and make

Laying of CAT VI data Cable including required switches

All internal wiring shall be with PVC insulated stranded copper conductor cables, surface type in PVC rigid channels of heavy quality

The works shall be carried out as per CPWD specifications and other applicable statues.

The work will be carried out by 'A / B' Class Licensed Electrical contractors only.

The work will be carried out as per general layout of wiring points, switches and plug fittings and telephone points which has been approved by the Project Engineer.

On completion of the work, MGPS Installer will submit as built drawings.

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# SAMPLE BILL OF QUANTITY (BOQ) FOR 600 BEDDED HOSPITAL

| Sl. No. | Description of work | Qty. | Unit. | Unit |
|---|---|---|---|---|
| | PART-A: GAS PLANT EQUIPMENT | | | |
| 1 | SITC of Quadraplex MEDICAL AIR COMPRESSOR SYSTEM, multi drive control mode, Screw air compressor with foundation, Filtration system, receiver, electrical connection from compressor to control panel and all as required as per specification. Entire system shall be installed as a package and compatible to fulfill the demand of system. Product should be as per specification. As per approved make attached. | 1.00 | Set | P. set |
| | Main component of system are as below | | | |
| 1.1 | Air compressor with capacity 5000 Ltr. (+/- 5%) with suitable motor as required | 4 | no. | |
| 1.2 | Air receiver tank 6000 Ltr. or (2000 x 3) ltr | 1 | set | |
| 1.3 | Air filtration Set as per specification | 2 | no. | |
| 1.4 | Air dryer suitable capacity | 2 | no. | |
| 1.5 | Air Pr. Reducing Station 4-Bar & 7-Bar (Duplex) | 1 | set | |
| 2 | SITC of Quadraplex MEDICAL VACUUM SYSTEM. The package shall consist of Reciprocating Vacuum pumps ( including civil foundation and electrical wiring of suitable capacity from Pump to electrical panel and non-return valve complete ) with suitable hp motor. The vacuum pump, motor and associated accessories shall be installed as a package by the manufacturer/installer, and not as discrete items. Complete system are as per specification. As per approved make attached. | 1.00 | Set | P. set |
| | Main component of system are as below | | | |
| 2.1 | Reciprocating Vacuum Pump With capacity 4200 Ltr (+/- 5%) with suitable Motor | 4 | no. | |
| 2.2 | Pressure Switch | 2 | no. | |

| | | | | |
|---|---|---|---|---|
| 2.3 | Vacuum Receiver tank 2000 Ltr. | 4 | no. | |
| 2.4 | Silencer muffler type | 4 | no. | |
| 2.5 | Vacuum Bacterial Filter | 2 | no. | |
| 3 | OXYGEN SUPPLY SYSTEM | | | |
| 3.1 | SITC of OXYGEN MANIFOLD minimum of 2 x20cylinders oxygen manifold extendable type with middle frame alongwith tail pipe as size given in the drawings having top frame comprising of high pressure copper pipe with high pressure brass fitting made of high tensile brass, NRV and high pressure copper tailpiece made of high pressure copper pipe. 1x20 bank shall be a reserve source of oxygen supply. It shall automatically supply the pipeline when primary source becomes exhausted or fails due to any reason. The system shall have source shut-off valve for easy changing and positioning, without hook. The cylinder should be placed with the help of cylinder brackets and fixing chains which should be zinc plated appropriate. (Gas cylinders are not in the scope of this work). Product should be as per specification. As per approved make attached. | 1.00 | Nos | Each |
| 3.2 | S.I.T.C of Imported CE Marked compliant with HTM or NFPA Oxygen Change-Over Reduction Box (Automatic Control Panel) of Digital fully Automatic type, capable of switching from "Bank in Use" to "Reserve Bank" without fluctuation in delivery line pressure and without the need for external electrical power. The Changeover panel shall be rated for min. 180 QMH at 400 kPA, and shall include the following accessories. Panel shall comply with HTM/ISO & as per specification. As per approved make attached. | 1.00 | Nos | Each |
| | Main component / feature of system are as below | | | |
| | Power Supply Module to provide power supply for alarm system display | | | |
| | Signalling Module for Pressure monotoring and Alarm Activation | | | |
| | Double line pressure Regulator | | | |
| | High and Low Limit Pressure Switches | | | |
| | Changeover and safety valve | | | |
| | Pressure Adjustment system (for working Pressure) | | | |



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| Sl. No. | Description of work | Qty. | Unit. | Unit |
|---|---|---|---|---|
| | Touch panel (LCD Display) software menu based control and supervision | | | |
| | Pressure Transmitter for Working Pressure Indication | | | |
| | easily upward opening with damper hinged door | | | |
| | Panel constructed with Stainless Steel material | | | |
| | having data logging facility for consumption or flow of gases on weekly/monthly basis | | | |
| | Ball Valve | | | |
| | able to inteface with network to provide real time supervision | | | |
| 3.3 | Oxygen Emergency System(5+5):- The oxygen emergency system contains 10 nos. Gas cylinder manifold along with copper header, Brass Non Return valve & High pressure copper tail pipe for each cylinder complete. product should be as per specification. As per approved make attached. | 1.00 | no. | Each |
| 4 | NITROUS OXIDE SUPPLY SYSTEM | | | |
| 4.1 | SITC of NITROUS OXIDE MANIFOLD SYSTEM minimum of 4 x2 cylinders and reserve source of nitrous oxide will be 2x1 cylinders. Cylinder size shall be as given in the drawings having top frame comprising of high pressure copper pipe with high pressure brass fitting made of high tensile brass, NRV, high pressure copper tailpiece made of high pressure copper. Reserve source of N2O shall automatically supply the pipeline when primary source of supply become exhausted or fails due to any reason. (Gas cylinders are not in the scope of this work). Product should be as per specification. As per approved make attached. | 1.00 | Nos | Each |
| 4.2 | S.I.T.C of Imported CE marked Nitrous Oxide Change-Over Reduction Box (Automatic Control Panel conforming to HTM/ ISO ) of Digital fully Automatic type, capable of switching from "Bank in Use" to "Reserve Bank" without fluctuation in delivery line pressure and without the need for external electrical power. Product should be as per specification. As per approved make attached. | 1.00 | Nos | Each |
| | Main component / feature of system are as below | | | |



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| | | | | |
|---|---|---|---|---|
| | Power Supply Module to provide power supply for alarm system display | | | |
| | Signalling Module for Pressure monotoring and Alarm Activation | | | |
| | Double line pressure Regulator | | | |
| | High and Low Limit Pressure Switches | | | |
| | Changeover and safety valve | | | |
| | Pressure Adjustment system (for working Pressure) | | | |
| | Touch panel (LCD Display) software menu based control and supervision | | | |
| | Pressure Transmitter for Working Pressure Indication | | | |
| | easily upward opening with damper hinged door | | | |
| | Panel constructed with Stainless Steel material | | | |
| | having data logging facility for consumption or flow of gases on weekly/monthly basis | | | |
| | Ball Valve | | | |
| | able to inteface with network to provide real time supervision | | | |
| 4.3 | Nitrous Oxide Emergency Manifold:- The Nitrous Oxide Emergency system contains 2 Nos Gas cylinder manifold along with copper header, Brass Non Return valve & High pressure copper tail pipe for each cylinder and one number of high pressure regulator. product should be as per specification. As per approved make attached. | 1.00 | no. | Each |
| 5 | MASTER ALARM (IMPORTED) & GAS SUPERVISION SYSTEM | | | |
| 5.1 | Plant/Master Gas Alarm:- S.I.T.C. of Imported CE marked (with CE Number) Master Gas Alarm for 4-gases conforming to HTM/NFPA. This panel shall be able to test Short Circuit Fault, Open Circuit Fault, Source Equipment Fault and include the a) Dual Circuit LED Indicators. b) Test facility to check LED c) Test facility to check LED Integrity . Panel shall be equipped with Micro-processor based alarm. product should be as per specification. As per approved make attached. | 1.00 | Nos | Each |
| | | | | |



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| Sl. No. | Description of work | Qty. | Unit. | Unit |
|---|---|---|---|---|
| 5.2 | Gas Supervision System (GSS): S.I.T.C. of GSS (Gas suppervision system) is a software, which should be able to communicate and provide realtime data access and alarm/events from all Harware (Manifolds, Plants, Control closing boxes) | 1.00 | Nos | Each |
| 6 | Combined Electrical Control Panel for Medical Air Compressors & Vacuum Pumps | 1.00 | Nos | Each |
| | PART-B (GAS DISTRIBUTION EQUIPMENTS) | | | |
| 7 | Terminal Outlets:- SITC of Terminal Outlets gas specific for the services indicated (viz. O2, Air & Vacuum) and to accept only compatible quick connect Geometric Index type steel adapters as HTM/NFPA standard, CE Certified/UL Listed as per drawings and as required. product should be as per specification. As per approved make attached. | | | |
| 7.1 | Oxygen Outlet | 839.00 | Nos | Each |
| 7.2 | Vacuum Outlet | 839.00 | Nos | Each |
| 7.3 | MA-4 Outlet | 388.00 | Nos | Each |
| 7.4 | SA-7 Outlet | 12.00 | Nos | Each |
| 7.5 | Nitrous Oxide Outlet | 20.00 | Nos | Each |
| 8 | SITC of gas lockable AVSU/CONTROL-CLOSING VALVE BOXES (INTEGRATED WITH AREA ALARM) with integrated alarm system as per specifications, and as required. Product should be as per specification. As per approved make attached. | | | |
| | Having data logging facility | | | |
| | Touch panel software menu based control and supervision | | | |
| | Must have Gas Pressure &Temprature alarm facility LED digital display, audio visual feature | | | |
| | Must have emergency feed facility in case of shutdown for interrupted supply | | | |
| | SS sheet construction, CE certified/UL Listed with relevant notified no. on it as required, entry/ exist of gases from upward direction | | | |



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|---|---|---|---|---|
| 8.1 | 2 Services (Oxygen, Vacuum) | 1.00 | Nos | Each |
| 8.2 | 3 Services (Oxygen, MA-4, Vacuum) | 23.00 | Nos | Each |
| 8.3 | 4 Services (Oxygen, MA-4, Nitrous Oxide, Vacuum) | 4.00 | Nos | Each |
| 8.4 | 5 Services (Oxygen, MA-4, MA-7, Nitrous Oxide, Vacuum) | 8.00 | Nos | Each |
| 9 | SITC of Modular bed head panel, with provision of gas outlet, electrical, 900 mm long, made of high grade of aluminum. Fabricated by extrusion method and powder coated as per approved colors.as per specification and drawing | 562.00 | Nos | Each |
| 10 | Copper Piping:- SITC of copper pipes, for Medical Gases, complete with elbows, flanges, specials, others fittings, and steel supports. The copper pipe should be of solid drawn seamless deoxidized, un-arsenical, tempered and of degreased material conforming to BS-EN 13348/ASTM B819, of copper pipe. must be certified and inspected by third party inspection agency like LLoyds/SGS/TUV etc. As per approved make attached. | | | |
| 10.1 | 12 mm OD | 3294.28 | Mtrs | P. Mtr |
| 10.2 | 15 mm OD | 2895.00 | Mtrs | P. Mtr |
| 10.3 | 22 mm OD | 3873.00 | Mtrs | P. Mtr |
| 10.4 | 28 mm OD | 1030.00 | Mtrs | P. Mtr |
| 10.5 | 42 mm OD | 280.00 | Mtrs | P. Mtr |
| 10.6 | 54 mm OD | 150.00 | Mtrs | P. Mtr |
| 10.7 | 76 mm OD | 112.50 | Mtrs | P. Mtr |
| 11 | Isolation valve - All valves are to be ball valves type and PTFE or Teflon seals. They shall be suitable for a working pressure of 10.2 Kg/cm² gauge. Valves shall be fitted into the pipeline by means of capillary hard soldered joints containing silver. it should be open/close with help of handle with rotation of 90 | | | |



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|---|---|---|---|---|
| | degree. As per approved make attached. | | | |
| | | | | |
| Sl. No. | Description of work | Qty. | Unit. | Unit |
| 11.1 | 12 mm | 49.00 | Nos | Each |
| 11.2 | 15 mm | 170.00 | Nos | Each |
| 11.3 | 22 mm | 133.00 | Nos | Each |
| 11.4 | 28 mm | 30.00 | Nos | Each |
| 11.5 | 42 mm | 11.00 | Nos | Each |
| 11.6 | 54 mm | 6.00 | Nos | Each |
| | PART-C (MEDICAL GAS PIPELINE SYSTEM ACCESSORIES) | | | |
| 12 | SITC Oxygen Flow Meter - Made from brass, chrome plated. It shall be back pressure compensated type having housing of Polycarbonate autoclavable reusable flow range 0-15 LPM. Fitted with matching adopter for oxygen outlet point and humidifier shall be compatible with flowmeter and reusable and as per specifications and as required. With suitable attachment steel adopter/prob. Product should be as per specification. As per approved make attached. | 599.00 | Nos | Each |
| 13 | SUCTION UNITS: | | | |
| 13.1 | SITC Ward Vacuum Unit - Regulator capable of controlling vacuum between 0 to 760 mm Hg and Polycarbonate autoclavable, reusable type receiver jar of not less 600 ml. Vacuum regulator shall have a dial gauge, on/off switch, valve control knob and as per specifications and as required. with suitable attachment steel adopter/probe. Product should be as per specification. As per approved make attached. | 547.00 | Nos | Each |
| 13.2 | SITC Ward Vacuum Unit (Paed.) - Regulator capable of controlling vacuum between 0 to 300mm Hg and Polycarbonate autoclavable, reusable type receiver jar of not less 600 ml. Vacuum regulator shall have a dial gauge, on/off switch, valve control knob and as per specifications and as required. with suitable attachment steel adopter/probe. Product should be as per specification. As per approved make attached. | 151.00 | Nos | Each |



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|---|---|---|---|---|
| 14 | SITC of Operation Theatre Suction Trolley- having 2 Nos. 2000 ml receiver jars of Polycarbonate autoclavable up to 121 *C, reusable and mounted on trolley with wheel arrangement. The trolley shall have one number of vacuum regulator having regulation control between 0-760 mm Hg and interconnecting suction tubes with suitable attachment steel adopter/prob. Product should be as per specification. As per approved make attached. | 18.00 | Nos | Each |
| 15 | CYLINDERS & TROLLEY (RATE ONLY) | | | |
| 15.1 | CYLINDER D-TYPE (EMPTY) OXY/N2O | 1 | Nos | Each |
| 15.2 | TROLLEY FOR D-TYPE CYLINDER | 1 | Nos | Each |
| 16 | S.I.T.C. of QUEUE MANAGEMENT SYSTEM (QMS) upto 8-counters as per technical specification | 1 | Set | Each |

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शासनादेश संख्या- / /71-1-2020-जी-307/2017टी0सी0,

दिनॉक नवम्बर, 2020 का संलग्नक-3 (मार्गदर्शिका)

## SAMPLE SOP FOR 500 BEDDED HOSPITAL ( TO BE DESIGN AS PER HOSPITAL SPECIFICATIONS)

### Location of Terminals & Zonal Accessories with consumption calculations

| | | | GAS TERMINAL DETAIL | | | | | | ACCESSORIES | | | | | | | ISOLATION VALVE | | | | | | CCB (AVSU+ALARM) | | | | DESIGN & DIVERSIFIED FLOW (LPM) CALCULATION AS PER HTM 02-01 | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SL. NO. | AREA/LOCATION | NO OF BEDS | OXY | N2O | AIR-4 | AIR-7 | AGSS | VAC | BED PANEL / WALL(W) / PENDANT (P) | FLOW METER | WALL SUCTION UNIT-ADULT | WALL SUCTION UNIT-PAED. | THEATRE SUCTION UNIT | PENDANT (ANAES.) | PENDANT (SURGEON) | 12 MM | 15MM | 22MM | 28MM | 42MM | 54 MM | 2 GAS | 3 GAS | 4 GAS | 5 GAS | FLOW CAL-OXY | FLOW CAL-N2O | FLOW CAL-AIR | FLOW CAL-VAC |
| | GROUND FLOOR | | | | | | | | | | | | | | | | | 3 | 1 | | | | | | | | | | |
| | EXAMINATION ROOM | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | 1 | | | 10.00 | 0 | 0 | 50 |
| | X-RAY | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 50 |
| | CT-SCAN | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 50 |
| | X-RAY | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 50 |
| | MRI | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 50 |
| | ULTRASOUND | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 50 |
| | EQUIPMENT STORAGE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | | | | |
| | RECOVERY ROOM | 3 | 6 | | 3 | | | 6 | 3 | 3 | 3 | | 0 | 0 | 0 | | | | | | | | | | | 13.00 | 0 | 45 | 60 |
| | EMERGENCY OT-1 & 2 | 2 | 8 | 2 | 4 | 2 | 2 | 8 | P | 2 | 2 | | 2 | 2 | 2 | | | | | | | | | 2 | | 106.00 | 21 | 567.5 | 120 |
| | EM. TRIAGE (12 BED) | 12 | 12 | | 12 | | | 12 | 12 | 12 | 12 | | 0 | 0 | 0 | | | | | | | | 1 | | | 116.50 | 0 | 47.5 | 150 |
| | OBS TRIAGE | 2 | 2 | | 2 | | | 2 | 2 | 2 | 2 | | 0 | 0 | 0 | | | | | | | | | | | 11.50 | 0 | 50 | 45 |
| | EXAMINATION ROOM | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | | | | | | | | | | | 10.00 | 0 | 0 | 40 |
| | OBSSERVATION & RECOVERY BED | 4 | 8 | | 4 | | | 8 | 4 | 4 | 4 | | 0 | 0 | 0 | | | | | | | | | | | 14.50 | 0 | 70 | 55 |
| | PROC./MIN OR OT | 1 | 4 | 1 | 2 | 1 | 1 | 4 | P | 1 | 1 | | 1 | 1 | 1 | | | | | | | | | | | 100.00 | 15 | 390 | 80 |
| | FIRST FLOOR | | | | | | | | | | | | | | | | | 2 | 1 | | | | | | | | | | |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EM. WARD 1 TO 6 | 48 | 48 | | 48 | | | 48 | 48 | 48 | 48 | | 0 | 0 | 0 | | 24 | 12 | | | | | | | | 71.75 | 0 | 131.25 | 275 |
| | TREATMENT ROOM | 1 | 2 | | 1 | | | 2 | 1 | 1 | 1 | | 0 | 0 | 0 | | 2 | 1 | | | | | 1 | | | 10.00 | 0 | 20 | 40 |
| | EQUI. ROOM | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | - | | | |
| | EARLY INT. (DISASTER) WD 1 TO 5 | 40 | 40 | | 40 | | | 40 | 40 | 40 | 40 | | 0 | 0 | 0 | | 20 | 10 | | | | | 1 | | | 61.50 | 0 | 112.5 | 235 |
| | SECOND FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | | 4 | 1 | | | | | | - | | | |
| | POST LABOUR | 12 | 24 | | 12 | | | 24 | 12 | 12 | 12 | | 0 | 0 | 0 | | 2 | 1 | | | | | | | | 26.50 | 0 | 150 | 95 |
| | POST OP. | 4 | 8 | | 4 | | | 8 | 4 | 4 | 4 | | 0 | 0 | 0 | | 4 | 2 | | | | | 1 | | | 14.50 | 0 | 70 | 55 |
| | EQUIPMENT ROOM | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | - | | | |
| | OT-1, 2 | 2 | 8 | 2 | 4 | 2 | 2 | 8 | P | 2 | 2 | | 2 | 2 | 2 | | | | | | | | | | 2 | 106.00 | 21 | 567.5 | 120 |
| | LABOUR ROOM-SEPTIC-2LT | 2 | 4 | 2 | 2 | | | 4 | 2 | 2 | 1 | 1 | 2 | | | | | | | | | | | | | 27.50 | 278 | 50 | 50 |
| | ECLAMPSIA | 1 | 1 | | 1 | | | 1 | 1 | 1 | 1 | | 0 | 0 | 0 | | 2 | 1 | | | | | | 1 | | 10.00 | 0 | 80 | 40 |
| | LABOUR ROOM-CLEAN-4LT | 4 | 8 | 4 | 4 | | | 8 | 2 | 4 | 1 | 1 | 4 | | | | | | | | | | | | | 30.50 | 284 | 70 | 70 |
| | FIRST STAGE WARD (PRE-LABOUR) | 15 | 15 | | | | | 15 | W | 15 | 15 | | 0 | 0 | 0 | | 2 | 2 | | | | | | | | 31.00 | 0 | 0 | 40 |
| | INTRAPARTUM FETAL MONITORING ROOM | 2 | 4 | | 2 | | | 4 | 2 | 2 | 2 | | 0 | 0 | 0 | | 2 | 1 | | | | | | | | 14.50 | 0 | 120 | 50 |
| | THIRD FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | | 4 | 1 | | | | | | - | | | |
| | OT-1 TO 6 | 6 | 24 | 6 | 12 | 6 | 6 | 24 | P | 6 | 6 | | 6 | 6 | 6 | | | | | | | | | | 6 | 130.00 | 45 | 840 | 280 |
| | PRE- OP | 9 | 18 | | 9 | | | 18 | 9 | 9 | 9 | | 0 | 0 | 0 | | | | | | | | 1 | | | 22.00 | 0 | 120 | 80 |
| | DIALYSIS WARD | 8 | 8 | | 8 | | | 8 | 8 | 8 | 8 | | 0 | 0 | 0 | | | | | | | | 1 | | | 20.50 | 0 | 110 | 40 |
| | POST OP. | 12 | 24 | | 12 | | | 24 | 12 | 12 | 12 | | 0 | 0 | 0 | | 4 | 2 | | | | | | | | 26.50 | 0 | 150 | 95 |
| | GENERAL EQUIPMENT STORE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | - | | | |
| | | | GAS TERMINAL DETAIL | | | | | | ACCESSORIES | | | | | | | ISOLATION VALVE | | | | | | CCB (AVSU+ALARM) | | | DESIGN & DIVERSIFIED FLOW (LPM) CALCULATION AS PER HTM 02-01 | | | |



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| | AREA/LOCATION | NO OF BEDS | OXY | N2O | AIR-4 | AIR-7 | AGSS | VAC | BED PANEL / WALL(W) / PENDANT (P) | FLOW METER | WALL SUCTION UNIT-ADULT | WALL SUCTION UNIT-PAED. | THEATRE SUCTION UNIT | PENDANT (ANAES.) | PENDANT (SURGEON) | 12 MM | 15MM | 22MM | 28MM | 42MM | 54 MM | 2 GAS | 3 GAS | 4 GAS | 5 GAS | FLOW CAL-OXY | FLOW CAL-N2O | FLOW CAL-AIR | FLOW CAL-VAC |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | FOURTH FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | 2 | 1 | | | | | | | | | | |
| | POST NATAL WARD 1 TO 6 | 48 | 96 | | 48 | | | 96 | 48 | 48 | 48 | 48 | 0 | 0 | 0 | | 24 | 12 | | | | | 1 | | | 80.50 | 0 | 160 | 70 |
| | EQUIP. STORE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | | | | |
| | MOTHER'S ROOM (OUT BORN NICU) | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 40 |
| | OUT BORN NICU | 13 | 26 | | 13 | | | 26 | 13 | 13 | 13 | 13 | 0 | 0 | 0 | | | | | | | | 1 | | | 28.00 | 0 | 160 | 160 |
| | NICU TRIAGE CUM PROC. | 1 | 2 | 1 | 1 | | | 2 | 1 | 1 | 1 | 1 | | | | | 3 | 1 | | | | | | | | 10.00 | 20 | 40 | 40 |
| | NICU | 23 | 46 | | 23 | | | 46 | 23 | 23 | 23 | 23 | 0 | 0 | 0 | | | | | | | | | | | 43.00 | 0 | 260 | 260 |
| | NICU ISOLATION CASES | 2 | 4 | | 2 | | | 4 | 2 | 2 | 2 | 2 | 0 | 0 | 0 | | 2 | 1 | | | | | | | | 11.50 | 0 | 50 | 50 |
| | NICU TRIAGE CUM PROC. | 1 | 2 | 1 | 1 | | | 2 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | | 3 | 1 | | | | | 1 | | | 10.00 | 20 | 40 | 40 |
| | MOTHER'S ROOM (NICU) | 1 | 1 | | | | | 1 | W | 1 | 1 | | 0 | 0 | 0 | 2 | | | | | | | | | | 10.00 | 0 | 0 | 40 |
| | FIFTH FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | 2 | 1 | | | | | | | | | | |
| | ANTE. NATAL WARD (8 BED x 6) | 48 | 48 | | 48 | | | 48 | 48 | 48 | 48 | | 0 | 0 | 0 | | 12 | 12 | | | | | 1 | | | 80.50 | 0 | 160 | 70 |
| | EQUIP. STORE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | | | | |
| | SURGICAL WARD (8 BED x 6) | 48 | 48 | | | | | 48 | 48 | 48 | 48 | | 0 | 0 | 0 | | 12 | 12 | | | | | 1 | | | 80.50 | 0 | 0 | 40 |
| | TREATMENT ROOM | 1 | 2 | | 1 | | | 2 | 1 | 1 | 1 | | | | | | 2 | 1 | | | | | | | | 10.00 | 0 | 20 | 40 |
| | SIXTH FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | 2 | 1 | | | | | | | | | | |
| | GYNAE. ICU | 13 | 26 | | 13 | | | 26 | 13 | 13 | 13 | | 0 | 0 | 0 | | | | | | | | 1 | | | 64.00 | 0 | 560 | 160 |
| | SURGICAL ICU | 13 | 26 | | 13 | | | 26 | 13 | 13 | 13 | | 0 | 0 | 0 | | | | | | | | 1 | | | 64.00 | 0 | 560 | 160 |



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|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | EQUIP. STORE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | | | | | |
| | GYNAE. WARD | 48 | 48 | | | | | 48 | 48 | 48 | 48 | | 0 | 0 | 0 | | 12 | 12 | | | | | | | | | 80.50 | 0 | 0 | 40 |
| | TREATMENT ROOM | 1 | 2 | | 1 | | | 2 | 1 | 1 | 1 | | 0 | 0 | 0 | | 2 | 1 | | | | | | | | | 10.00 | 0 | 20 | 40 |
| | SEVENTH FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | 2 | 1 | | | | | | | | | | | |
| | MEDICINE ICU | 13 | 26 | | 13 | | | 26 | 13 | 13 | 13 | | 0 | 0 | 0 | | | | | | | | 1 | | | | 64.00 | 0 | 560 | 160 |
| | PAED. ICU | 13 | 26 | | 13 | | | 26 | 13 | 13 | 13 | 13 | 0 | 0 | 0 | | | | | | | | | | | | 64.00 | 0 | 560 | 160 |
| | EQUIP. STORE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | | | | | |
| | GYNAE. WARD | 48 | 48 | | | | | 48 | 48 | 48 | 48 | | 0 | 0 | 0 | | 12 | 12 | | | | | | | | | 80.50 | 0 | 0 | 40 |
| | TREATMENT ROOM | 1 | 2 | | 1 | | | 2 | 1 | 1 | 1 | | 0 | 0 | 0 | | 2 | 1 | | | | | | | | | 10.00 | 0 | 20 | 40 |
| | EIGHTH FLOOR | | | | | | | 0 | | 0 | 0 | | 0 | 0 | 0 | | | 2 | 1 | | | | | | | | | | | |
| | PAED. WARD | 48 | 48 | | | | | 48 | 48 | 48 | 0 | 48 | 0 | 0 | 0 | | 12 | 12 | | | | 1 | | | | | 80.50 | 0 | 0 | 40 |
| | EQUIP. STORE | 0 | 1 | | 1 | | | 1 | W | 0 | 0 | | 0 | 0 | 0 | 3 | | | | | | | | | | | | | | |
| | WARD (8 BED x 2) | 16 | 16 | | | | | 16 | 16 | 16 | 16 | | 0 | 0 | 0 | | 4 | 4 | | | | | | | | | 32.50 | 0 | 0 | 40 |
| | TREATMENT ROOM | 1 | 2 | | 1 | | | 2 | 1 | 1 | 1 | | 0 | 0 | 0 | | 2 | 1 | | | | | | | | | 10.00 | 0 | 20 | 40 |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | GAS PLANT ROOM / PIPE LINE | | 1 | 1 | 1 | 1 | 1 | 1 | | | | | | | | 6 | 4 | 3 | 15 | 9 | 6 | | | | | 787.30 | 281.60 | 2,780.50 | 1,674.00 |
| | TOTAL | 599 | 839 | 20 | 388 | 12 | 12 | 839 | 562 | 599 | 547 | 151 | 18 | 12 | 12 | 49 | 170 | 133 | 30 | 11 | 6 | 1 | 23 | 4 | 8 | 2,755.55 | 985.6 | 9731.75 | 5859 |

| Gas Plant Capacity as derived in above table | Consumption (Lpm) | Plant Capacity (Considering Future Expansion & Age Performance Factor In 10 Years& Pr. loss in distribution) | Plant Configuration (Safe to use next 10 years) |
|---|---|---|---|
| Oxygen | 2756 | 3000 | Primary= 20 CylMaifold<br>Secondary= 20 CylMaifold<br>Reduction box Oxy.= 3000 LPM |



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| | | | (180QMH)<br>Third= Emergency 5+5 Cyl. Manifold |
| Nitrous Oxide | 986 | 1200 | Primary= 04CylMaifold<br>Secondary= 04CylMaifold<br>Reduction box N2O= 1200-1250 LPM (80QMH)<br>Third= Emergency 02 Cyl. Manifold |
| Air System (4bar + 7bar) | 9732 | 10000 | Quadraplex system each compressor 5000 LPM (± 5%) |
| Vacuum System | 5859 | 8400 | Quadraplex system each pump capacity PD= 4200 LPM (± 5%) |

| | Sl. No. | Description of work | Qty. | Unit | Unit |
|---|---|---|---|---|---|
| Remark | | PART-A: GAS PLANT EQUIPMENT | | | |
| | 1 | MEDICAL AIR COMPRESSOR SYSTEM, Receprocating air compressor with foundation, Filtration system, receiver, electrical connection from compressor to control panel and all as required as per specification. Entire system shall be installed as a package and compatible to fulfill the demand of system. Product should be as per specification & as per approved make attached. | | | |
| upto 100 Bed Hospital | | Main component of system are as below | | | |
| | 1.1 | Receprocating air compressor with suitable motor of capacity 60 CFM @8 Bar (+/- 5%) | 2 | no. | Each |
| | 1.2 | Air receiver tank 2000 Ltr. | 1 | no. | Each |
| | 1.3 | Three stage Air filtration Set as per specification | 2 | no. | Each |
| | 1.4 | Air dryer Desicant type with pre filter 60 CFM (1CFM = 28,31 LPM) | 2 | no. | Each |



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| upto 200 Bed Hospital | | Main component of system are as below | | | |
| | 1.1 | Receprocating air compressor with suitable motor of capacity 60 CFM @8 Bar (+/- 5%) | 3 | no. | Each |
| | 1.2 | Air receiver tank 2000 Ltr. | 1 | no. | Each |
| | 1.3 | Three stage Air filtration Set as per specification | 2 | no. | Each |
| | 1.4 | Air dryer Desicant type with pre filter 60 CFM | 2 | no. | Each |
| upto 300 Bed Hospital | | Main component of system are as below | | | |
| | 1.1 | Receprocating air compressor with suitable motor of capacity 40 CFM @8 Bar (+/- 5%) | 4 | no. | Each |
| | 1.2 | Air receiver tank 3000 Ltr. | 1 | no. | Each |
| | 1.3 | Three stage Air filtration Set as per specification | 2 | no. | Each |
| | 1.4 | Air dryer Desicant type with pre filter 80 CFM | 2 | no. | Each |
| Above 300 Bed Hospital | | Main component of system are as below | | | |
| | 1.1 | Receprocating air compressor with suitable motor of capacity 60 CFM @8 Bar (+/- 5%) | 4 | no. | Each |
| | 1.2 | Air receiver tank 3000 Ltr. | 1 | no. | Each |
| | 1.3 | Three stage Air filtration Set as per specification | 2 | no. | Each |
| | 1.4 | Air dryer Desicant type with pre filter 120 CFM | 2 | no. | Each |
| | 1.5 | Air Pr. Reducing Station 4-Bar (Duplex) | 1 | Set | Each |
| | 1.6 | Air Pr. Reducing Station 7-Bar (Duplex) | 1 | Set | Each |
| | 2 | MEDICAL VACUUM SYSTEM: Receprocating Vacuum Pump with foundation, Filtration system, receiver, electrical connection from compressor to control panel and all as required as per specification. Entire system shall be installed as a package and compatible to fulfill the demand of system. Product should be as per specification & as per approved make attached. | | | |
| upto 100 Bed Hospital | | Main component of system are as below | | | |
| | 2.1 | Reciprocating Vacuum Pump With capacity 110 CFM (+/- 5%) with suitable Motor & Pressure | 2 | no. | Each |



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| | | Switch | | | |
| | 2.3 | Vacuum Receiver tank 2000 Ltr. | 1 | no. | Each |
| | 2.4 | Vacuum Bacterial Filter for pump capacity. | 2 | no. | Each |
| upto 200 Bed Hospital | | Main component of system are as below | | | |
| | 2.1 | Reciprocating Vacuum Pump With capacity 110 CFM (+/- 5%) with suitable Motor & Pressure Switch | 3 | no. | Each |
| | 2.3 | Vacuum Receiver tank 2000 Ltr. | 1 | no. | Each |
| | 2.4 | Vacuum Bacterial Filter for pump capacity. | 2 | no. | Each |
| upto 300 Bed Hospital | | Main component of system are as below | | | |
| | 2.1 | Reciprocating Vacuum Pump With capacity 149 CFM (+/- 5%) with suitable Motor & Pressure Switch | 2 | no. | Each |
| | 2.3 | Vacuum Receiver tank 3000 Ltr. | 1 | no. | Each |
| | 2.4 | Vacuum Bacterial Filter for pump capacity. | 2 | no. | Each |
| upto 400 Bed Hospital | | Main component of system are as below | | | |
| | 2.1 | Reciprocating Vacuum Pump With capacity 149 CFM (+/- 5%) with suitable Motor & Pressure Switch | 3 | no. | Each |
| | 2.3 | Vacuum Receiver tank 2000 Ltr. | 2 | no. | Each |
| | 2.4 | Vacuum Bacterial Filter for pump capacity. | 2 | no. | Each |
| Above 400 Bed Hospital | | Main component of system are as below | | | |
| | 2.1 | Reciprocating Vacuum Pump With capacity 149 CFM (+/- 5%) with suitable Motor & Pressure Switch | 4 | no. | Each |
| | 2.3 | Vacuum Receiver tank 3000 Ltr. | 2 | no. | Each |
| | 2.4 | Vacuum Bacterial Filter for pump capacity. | 2 | no. | Each |
| | 3 | OXYGEN SUPPLY SYSTEM | | | |



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| | 3.1 | OXYGEN MANIFOLD- Oxygen manifold extendable type with middle frame along with tail pipe as size given, having top frame comprising of high pressure copper pipe with high pressure brass fitting made of high tensile brass, NRV and high pressure copper tailpiece made of high pressure copper pipe. one bank shall be a reserve source of oxygen supply. It shall automatically supply the pipeline when primary bank becomes exhausted or fails due to any reason. The system shall have source shut-off valve for easy changing and positioning. The cylinder should be placed with the help of cylinder brackets and fixing chains which should be zinc plated appropriate. (Gas cylinders are not in the scope of this work). Product should be as per specification. As per approved make attached. | | | |
| | A | 20+20 Size (500 & above Beded ) | 1.00 | Set | Each |
| | B | 16+16 Size (300 To 500 Beded ) | 1.00 | Set | Each |
| | C | 10+10 Size (100 To 200 Beded ) | 1.00 | Set | Each |
| | D | 8+8 Size (upto 100 Beded ) | 1.00 | Set | Each |
| | 3.2 | Oxygen Emergency System :- The oxygen emergency system contains Bulk Gas cylinder manifold along with copper header, Brass Non Return valve & High pressure copper tail pipe for each cylinder complete. system must be equiped with high pressure Regulator. product should be as per specification & approved make attached. | | | |
| | A | 2+2 Cylinder (Upto 100 Beded ) | 1.00 | Set | Each |
| | B | 3+3 Cylinder (100 Beded To 150 Beded) | 1.00 | Set | Each |
| | C | 4+4 Cylinder (150 Beded To 250 Beded) | 1.00 | Set | Each |
| | D | 5+5 Cylinder (250 Beded To 300 Beded) | 1.00 | Set | Each |
| | E | 6+6 Cylinder (300 Beded to 400 Beded) | 1.00 | Set | Each |
| | F | 8+8 Cylinder (400 & above Beded) | 1.00 | Set | Each |



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| | 3.3 | High Pressure Regulator for Oxygen Emergecy Manifolad system as per specification below mention capacity and approved make. | | | |
| | A | 1000 LPM at 400 Kpa (upto 200 Bed) | 1.00 | Set | Each |
| | B | 1500 LPM at 400 Kpa ( upto 300 Bed) | 1.00 | Set | Each |
| | C | 2500 LPM at 400 Kpa (above 300 Bed) | 1.00 | Set | Each |
| Imported | 3.4 | Notified CE Marked compliant with ISO 7396. Oxygen Change-Over Reduction Box (Automatic Control Panel) of Digital fully Automatic type, capable of switching from "Bank in Use" to "Reserve Bank" without fluctuation in delivery line pressure and without the need for external electrical power. The Changeover panel shall be rated for minimum capacity as mentioned below and shall include the mention accessories. Panel shall comply with HTM/ISO & as per specification. As per approved make attached.<br>Main component / feature of system are as below<br>• Power Supply Module to provide power supply for alarm system display<br>• Signaling Module for Pressure monitoring and Alarm Activation<br>• Double-line pressure Regulator<br>• High and Low Limit Pressure Switches<br>• Changeover and safety valve<br>• Touch panel (LCD Display) software menu based control and supervision<br>• Pressure Transmitter for Working Pressure Indication<br>• Panel constructed with Stainless Steel material<br>• having data logging facility for consumption or flow of gases on weekly/monthly basis<br>• able to interface with network to provide real time supervision | | | |
| | A | Min 750 LPM at 4 Bar / 400 kPA (up to 100 Bed ) | 1.00 | No | Each |
| | B | Min 1250 LPM at 4 Bar / 400 kPA (up to 300 Bed | 1.00 | No | Each |



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| | | ) | | | |
| | C | Min 2800 LPM at 4 Bar / 400 kPA (Above 300 Bed ) | 1.00 | No | Each |
| | 4 | NITROUS OXIDE SUPPLY SYSTEM | | | |
| | 4.1 | NITROUS OXIDE MANIFOLD- Nitrous Oxide manifold extendable type with middle frame along with tail pipe as size given, having top frame comprising of high pressure copper pipe with high pressure brass fitting made of high tensile brass, NRV and high pressure copper tailpiece made of high pressure copper pipe. one bank shall be a reserve source of oxygen supply. It shall automatically supply the pipeline when primary bank becomes exhausted or fails due to any reason. The system shall have source shut-off valve for easy changing and positioning. The cylinder should be placed with the help of cylinder brackets and fixing chains which should be zinc plated appropriate. (Gas cylinders are not in the scope of this work). Product should be as per specification. As per approved make attached. | 1.00 | Set | Each |
| | A | 6+6 Size (300 To above ) | | | |
| | B | 4+4 Size (100 To 300 Beded ) | | | |
| | C | 2+2 Size (upto 100 Beded ) | | | |
| | 4.2 | Nitrous Oxide Emergency Manifold :- The Nitrous Oxide emergency Manifold system contains Bulk Gas cylinder manifold along with copper header, Brass Non Return valve & High pressure copper tail pipe for each cylinder complete. system must be equiped with high pressure Regulator. product should be as per specification & approved make attached. | | | |
| | A | 2 Cylinder Emergency Manifold for Bulk Cylinder (upto 200 Bed) | 1.00 | Set | Each |
| | B | 4 Cylinder Emergency Manifold for Bulk Cylinder ( above 200 bed) | 1.00 | Set | Each |



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| Imported | 4.3 | Notified CE Marked compliant with ISO 7396. Oxygen Change-Over Reduction Box (Automatic Control Panel) of Digital fully Automatic type, capable of switching from "Bank in Use" to "Reserve Bank" without fluctuation in delivery line pressure and without the need for external electrical power. The Changeover panel shall be rated for minimum capacity as mentioned below and shall include the mention accessories. Panel shall comply with HTM/ISO & as per specification. As per approved make attached.<br>Main component / feature of system are as below<br>• Power Supply Module to provide power supply for alarm system display<br>• Signaling Module for Pressure monitoring and Alarm Activation<br>• Double line pressure Regulator<br>• High and Low Limit Pressure Switches<br>• Changeover and safety valve<br>• Touch panel (LCD Display) software menu based control and supervision<br>• Pressure Transmitter for Working Pressure Indication<br>• Panel constructed with Stainless Steel material<br>• having data logging facility for consumption or flow of gases on weekly/monthly basis<br>• able to interface with network to provide real time supervision | | | |
| | A | 500 LPM at 4 Bar / 400 kPA ((up to 300 Bed ) | 1.00 | Nos | Each |
| | B | Min 750 LPM at 4 Bar / 400 kPA (above 300 Bed ) | 1.00 | Nos | Each |
| Imported | 5 | Plant/Master Gas Alarm:- Notified CE marked (with CE Number) Master Gas Alarm for upto 5-gases conforming to HTM/NFPA. This panel shall be able to test Short Circuit Fault, Open Circuit Fault, Source Equipment Fault and include the<br>a) Dual Circuit LED Indicators.<br>b) Test facility to check LED | 1.00 | Nos | Each |



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| | | c) Test facility to check LED Integrity.<br><br>Panel shall be equipped with Micro-processor based alarm. Product should be as per specification. As per approved make attached. | | | |
| | 6 | Combined Electrical Control Panel for suitable Medical Air Compressors & Vacuum Pumps as required in hopsital for auto cascading and manual mode as required in compliance with ISO 7396 & specification with all required support foundation complete | | | |
| upto 100 Bed Hospital | A | FOR upto 4 Pump system as required and mention in system | 1.00 | Set | Each |
| upto 200 Bed Hospital | B | FOR upto 6 Pump system as required and mention in system | 1.00 | Set | Each |
| upto 300 Bed Hospital | C | FOR upto 6 Pump system as required and mention in system | 1.00 | Set | Each |
| upto 400 Bed Hospital | D | FOR upto 7 Pump system as required and mention in system | 1.00 | Set | Each |
| Above 400 Bed Hospital | E | FOR upto 8 Pump system as required and mention in system | 1.00 | Set | Each |
| | | PART-B (GAS DISTRIBUTION EQUIPMENTS) | | | |
| | 7 | GAS OUTLET/TERMINAL UNIT | | | |
| Imported | A | Terminal Outlets:- Terminal Outlets gas specific for the services indicated (viz. O2, Air & Vacuum) and to accept only compatible quick connect Pin/Geometric Index type adapters as Per ISO.7396 standard, Notified Body CE Certified/UL Listed as required. product should be as per specification & approved make. | | | |



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| | 7.1 | Oxygen Outlet | 1.00 | Nos | Each |
| | 7.2 | Vacuum Outlet | 1.00 | Nos | Each |
| | 7.3 | MA-4 Outlet | 1.00 | Nos | Each |
| | 7.4 | SA-7 Outlet | 1.00 | Nos | Each |
| | 7.5 | Nitrous Oxide Outlet | 1.00 | Nos | Each |
| Indiginous | B | Terminal Outlets:- Terminal Outlets gas specific for the services indicated (viz. O2, Air & Vacuum) and to accept only compatible quick connect Pin/Geometric Index type adapters as Per ISO 7396 standard. Manufactured in compliance with CE and ISO 13485 as per Specificatioon and approved make. | | | |
| | 7.1 | Oxygen Outlet | 1.00 | Nos | Each |
| | 7.2 | Vacuum Outlet | 1.00 | Nos | Each |
| | 7.3 | MA-4 Outlet | 1.00 | Nos | Each |
| | 7.4 | SA-7 Outlet | 1.00 | Nos | Each |
| | 7.5 | Nitrous Oxide Outlet | 1.00 | Nos | Each |
| | 8 | Suitable Gas Outlet Adopter compatible with required ward Accessories made from stainless steel as per current latest standard. | | | |
| | 8.1 | Oxygen Outlet | 1.00 | Nos | Each |
| | 8.2 | Vacuum Outlet | 1.00 | Nos | Each |
| | 8.3 | MA-4 Outlet | 1.00 | Nos | Each |
| | 8.4 | SA-7 Outlet | 1.00 | Nos | Each |
| | 8.5 | Nitrous Oxide Outlet | 1.00 | Nos | Each |
| Imported | 9 | Gas lockable AVSU/CONTROL-CLOSING VALVE BOXES with integrated alarm system as per specifications, and as required. Product should be as per specification and below mention feature. As per approved make attached.<br>• Having data logging facility<br>• Touch panel(LCD) software menu based control and supervision | | | |



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| | | • Must have Gas Pressure & Temperature alarm facility LED digital display, audio visual feature<br>• Must have emergency feed facility in case of shutdown for interrupted supply<br>• SS sheet construction<br>• CE certified/UL Listed with relevant notified no. on it as required<br>• entry/ exist of gases from upward direction | | | |
| | 9.1 | 2 Services (Oxygen, Vacuum) | 1.00 | Nos | Each |
| | 9.2 | 3 Services (Oxygen, MA-4, Vacuum) | 1.00 | Nos | Each |
| | 9.3 | 4 Services (Oxygen, MA-4, Nitrous Oxide, Vacuum) | 1.00 | Nos | Each |
| | 9.4 | 5 Services (Oxygen, MA-4, MA-7, Nitrous Oxide, Vacuum) | 1.00 | Nos | Each |
| | 10 | Area Alarm : Digital Area Gas Alarm for Required Services in Compliance with ISO 7396 satnadrd. Manufactured in compliance with CE and ISO 13485 as per Specificatioon and approved make. | | | |
| | 10.1 | 2 Services (Oxygen, Vacuum) | 1.00 | Nos | Each |
| | 10.2 | 3 Services (Oxygen, MA-4, Vacuum) | 1.00 | Nos | Each |
| | 10.3 | 4 Services (Oxygen, MA-4, Nitrous Oxide, Vacuum) | 1.00 | Nos | Each |
| | 10.4 | 5 Services (Oxygen, MA-4, MA-7, Nitrous Oxide, Vacuum) | 1.00 | Nos | Each |
| | 11 | Area Zonal valve Box for Required aservice as per ISO 7396 standard. Having Isolation valave, Pressure Gauge, Lcking Arrangement, transparent breakable front to break in case of emengency. Unit must be manufactured as per CE and ISO 13485 certifying facility as per specification and approved make. | | | |
| | 11.1 | 2 Services (Oxygen, Vacuum) | 1.00 | Nos | Each |
| | 11.2 | 3 Services (Oxygen, MA-4, Vacuum) | 1.00 | Nos | Each |
| | 11.3 | 4 Services (Oxygen, MA-4, Nitrous Oxide, | 1.00 | Nos | Each |



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| | | Vacuum) | | | |
| | 11.4 | 5 Services (Oxygen, MA-4, MA-7, Nitrous Oxide, Vacuum) | 1.00 | Nos | Each |
| | 12 | Modular Bed Head Panel, with provision of gas outlet, electrical Socket Switch , Data Point Nurse Call system, made of high grade aluminum. each panel must be equiped with IV Pole, Vacuum Slider, Utility Basket. Fabricated by extrusion method and powder coated as per approved colors. it has dual compartment facility seperate for gases and electrical services as per international standard for safety and service. Unit must be manufactured as per CE and ISO 13485 certifying facility as per specification and approved make. | | | |
| | 12.1 | upto 3 gas outlet 900 mm long | 1.00 | Set | Each |
| | 12.2 | for 4/5 gas outlet 1200 mm long | 1.00 | Set | Each |
| | 13 | Copper Piping:- copper pipes, for Medical Gases, complete with elbows, flanges, specials, others fittings, and steel supports. The copper pipe should be of solid drawn seamless deoxidized, un-arsenical, tempered and of degreased material conforming to BS-EN 13348/ASTM B819, of copper pipe. must be certified and inspected by third party inspection agency like LLoyds/SGS/TUV etc. As per approved make attached. | | | |
| | 13.1 | 12 mm OD | 0.00 | Mtrs | P. Mtr |
| | 13.2 | 15 mm OD | 0.00 | Mtrs | P. Mtr |
| | 13.3 | 22 mm OD | 0.00 | Mtrs | P. Mtr |
| | 13.4 | 28 mm OD | 0.00 | Mtrs | P. Mtr |
| | 13.5 | 42 mm OD | 0.00 | Mtrs | P. Mtr |



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| | 13.6 | 54 mm OD | 0.00 | Mtrs | P. Mtr |
| | 13.7 | 76 mm OD | 0.00 | Mtrs | P. Mtr |
| | 13.8 | 108 mm OD | 0.00 | Mtrs | P. Mtr |
| | 14 | Floor / Area Isolation valve - All valves are to be ball valves type and PTFE or Teflon seals. They shall be suitable for a working pressure of 10.2 Kg/cm² gauge. Valves shall be fitted into the pipeline by means of capillary hard soldered joints containing silver. it should be open/close with help of handle with rotation of 90 degree. As per approved make attached. | | | |
| | 14.1 | Isolation valve - All valves are to be ball valves type and PTFE or Teflon seals. They shall be suitable for a working pressure of 10.2 Kg/cm² gauge. Valves shall be fitted into the pipeline by means of capillary hard soldered joints containing silver. it should be open/close with help of handle with rotation of 90 degree. As per approved make attached. | | | |
| | A | 12 mm | 1.00 | Nos | Each |
| | B | 15 mm | 1.00 | Nos | Each |
| | C | 22 mm | 1.00 | Nos | Each |
| | D | 28 mm | 1.00 | Nos | Each |
| | E | 42 mm | 1.00 | Nos | Each |
| | F | 54 mm | 1.00 | Nos | Each |
| | G | 76 mm | 1.00 | Nos | Each |
| | H | 108 mm | 1.00 | Nos | Each |
| | 14.2 | Lockable Isolation valve - All valves are to be ball valves type and PTFE or Teflon seals. They shall be suitable for a working pressure of 10.2 Kg/cm² gauge. Valves shall be fitted into the pipeline by means of capillary hard soldered joints containing silver. it should be open/close | | | |



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| | | with help of handle with rotation of 90 degree. As per approved make attached. | | | |
| | A | 28 mm | 1.00 | Nos | Each |
| | B | 42 mm | 1.00 | Nos | Each |
| | C | 54 mm | 1.00 | Nos | Each |
| | D | 76 mm | 1.00 | Nos | Each |
| | E | 108 mm | 1.00 | Nos | Each |
| | | PART-C (MEDICAL GAS PIPELINE SYSTEM ACCESSORIES) | | | |
| | 15 | Oxygen Flow Meter - Made from brass, chrome plated. It shall be back pressure compensated type having housing of Polycarbonate autoclavable reusable flow range 0-15 LPM. Fitted with matching adopter for oxygen outlet point and humidifier shall be compatible with flowmeter and reusable and as per specifications and as required. Product should be as per specification. As per approved make attached. | 1.00 | Nos | Each |
| | 16 | SUCTION UNITS: | | | |
| | 16.1 | Ward Vacuum Unit - Regulator capable of controlling vacuum between 0 to 760 mm Hg and Polycarbonate autoclavable, reusable type receiver jar, Vacuum regulator shall have a dial gauge, on/off switch, valve control knob, hygrophobic filter and additional polycorbonate safety trap bottle as per specifications and as required. Product should be compliance with ISO 7396 standard & per approved make. | | | |
| | A | 600 ML Receiver Jar | 1.00 | Nos | Each |
| | B | 1000 ML Receiver Jar | 1.00 | Nos | Each |
| | 16.2 | Ward Vacuum Unit (Paed.) - Regulator capable of controlling vacuum between 0 to 300mm Hg and Polycarbonate autoclavable, reusable type receiver jar of not less 600 ml. Vacuum regulator shall have a dial gauge, on/off switch, | 1.00 | Nos | Each |



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| | | valve control knob and as per specifications and as required. Product should be as per specification. As per approved make attached. | | | |
| | 16.3 | Operation Theatre Suction Trolley- having 2 Nos. 2000 ml receiver jars of Polycarbonate autoclavable up to 121 *C, reusable and mounted on trolley with wheel arrangement. The trolley shall have one number of vacuum regulator having regulation control between 0-760 mm Hg and interconnecting suction tubes. Product should be as per specification. As per approved make attached. | 1.00 | Nos | Each |
| | 16.4 | Low pressure suction tube for suction outlet adopter as required | 1.00 | Mtrs | P. Mtr |
| | 17 | High pressure suction tube for suction Trolly & outlet adopter as required | 1.00 | Mtrs | P. Mtr |
| | 18 | OT Conversion kit attached with 5 Mtr Long HP tube with appropriate color code for specific gas. | | | |
| | 18.1 | KIT for oxygen | 1.00 | Nos. | Each |
| | 18.2 | KIT for Nitrous Oxide | 1.00 | Nos. | Each |
| | 18.3 | Kit for Air 4 | 1.00 | Nos. | Each |
| | 19 | CYLINDERS & TROLLEY | | | |
| | 19.1 | CYLINDER D-TYPE (EMPTY) water capacity 46.7 Ltr, PESO approved for OXY/N2O | 1 | Nos | Each |
| | 19.2 | TROLLEY FOR D-TYPE CYLINDER | 1 | Nos | Each |

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